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AGRICULTURE

OF

NEW-YORK:

COMPRISING

AN ACCOUNT OF THE CLASSIFICATION, COMPOSITION AND DISTRIBUTION OF THE SOILS AND ROCKS,

AND THE NATURAL WATERS OF THE DIFFERENT GEOLOGICAL FORMATIONS;

TOGETHER WITH A CONDENSED VIEW OF THE

CLIMATE AND THE AGRICULTURAL PRODUCTIONS OF THE STATE.

BY EBENEZER EMMONS, M. D.

VOLUME III.

ALBANY:
PRINTED BY C. VAN BENTHUYSEN.
1851.

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AGRICULTURE

OF

NEW-YORK:

COMPRISING

AN ACCOUNT OF THE CLASSIFICATION, COMPOSITION AND DISTRIBUTION
OF THE SOILS AND ROCKS,

AND AN ORIGINAL CATALOGUE AND DESCRIPTION OF THE GEOLOGICAL FORMATIONS

CLIMATE AND THE AGRICULTURAL PRODUCTIONS OF THE STATE

BY JOHN DELAFIELD JONES, M.D.

VOLUME ONE.

ALBANY:
PRINTED BY C. VAN BENTHUYSEN.
1850.

TO HIS EXCELLENCY HAMILTON FISH,

Governor of the State of New-York.

SIR,

It has been the good fortune of the People of this Commonwealth to have elected those men to preside over its interests who were positively instrumental in promoting science and learning, and who were especially active in promoting Agriculture, and the branches allied thereto. Your own recommendations and influence, touching these great interests, are highly appreciated by the people, as is evident from their united movements in establishing institutions which are designed to bear directly upon those objects, and which are specially designed to place them upon a scientific basis.

The subject matter of this volume, portions of which were submitted to your inspection, is eminently agricultural. As it was mainly composed during your administration, though not published, it is proper that it should be addressed to you. A variety of causes have operated unfavorably to its earlier publication, which I regret: still, I regret the more that it is imperfect. I hope, however, it may exercise some influence in aiding the interests of Agriculture in this State.

Most respectfully, your Servant,

EBENEZER EMMONS.

Albany, December 25, 1851.

PREFACE.

The five last years have witnessed a very great change in the system of fruit culture, as well as a great advance in the principles which lie at the foundation of Agriculture. This is seen in the call for agricultural periodicals and books. It is not now as formerly; a scientific agricultural work, ten years ago, would be excluded from the fireside of the farmer, because it employed names and words difficult to be understood, or even to pronounce; but now, we hear very little complaint on the score of hard names and technical phrases. Such works, too, were frequently regarded as theoretical, and as adapted only to a class of men styled book-farmers. It is now, however, conceded that books may teach the principles of Agriculture, and that the practical farmer may read and study them to great advantage. It will be seen that this volume is devoted partly to the description and illustration of the fruits of the State, and partly to the principles of practical agriculture. In the part devoted to fruits I have attempted to construct a better classification than we possessed. I do not know how it will be regarded by the learned in this branch of culture. The classification of varieties is always difficult, and when they are numerous, as in the apple and pear, it is increased. I may have failed in the application of the facts upon which my classification is based, for want of a full assortment of varieties; still, I believe the attempt to improve the classification of fruits is in the right direction.

It is due to myself to state, that many of the plates were engraved before fruit culture had received its impulse in New-York; and indeed a part of the work was printed before the best edition of Downing's work was published. Many difficulties and doubts have existed in the minds of some of our Pomologists, as it regarded the true name which had been given to many varieties. That I have fallen into error, in a few instances, is proba-

bly true, Most of the figures, however, will be found correct in outline and form. I am, however, dissatisfied with many, especially those which were printed at an early day; circumstances beyond my control have obliged me to give to the public some plates which are unworthy of a place in the volume. The fact is, both paper and printing are of that character that it was impossible to color the plates, handsomely: I inspected and corrected the proofs furnished me, and those were well executed; but it appears that the drawing upon the stone soon wore out, and hence bad impressions were often made, and which could not be converted afterwards, by colors, into handsome figures. I have also admitted varieties of apples which rank only as second rate: they are however good market apples. But there are other considerations than those of rank and value, which influenced me in publishing so many figures and plates. There is a philosophical interest in those products of organized matter, which multiply and run into varieties. What are the efficient and final causes by which, and for which these productions seem to increase in kinds so astonishingly? What cause is operative in the production of varieties? Is it original endowment, independent of climate; or is climate a cause which operates upon a susceptible constitution? I had in view, at one time, the exhibition of many varieties, with the view of contributing something for the illustration of these questions. I found, however, the questions beset with too many difficulties to be overcome, even in part, while engaged with the analyses of soils and vegetable products.

In conclusion, I feel bound to express a regret that this volume could not have been issued at an earlier day. The subject of which it mainly treats has gone far ahead in the last five years; and what in this volume might have been regarded as new, and which might, too, have aided the progress of pomology, will appear as less valuable, and of less importance. I may, however, commend to the attention of farmers the general principles of Agriculture which are expressed in the last part of the volume, together with the investigation of the milk of the cow. I can not but hope these facts will prove generally acceptable.

EBENEZER EMMONS.

Albany, December 5, 1851.

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REPORT

ON THE

AGRICULTURE OF THE STATE OF NEW-YORK.

PART III.

CHAPTER I.

ON THE FRUITS OF THE STATE.

1. General remarks on the adaptation of the climate of the state to the cultivation of fruit. 2. Change of views in regard to the importance of fruit. 3. Observations on the classification of varieties. 4. Scheme of the classification of apples.

The climate of New-York is adapted to the cultivation of all fruits which may be grown in a temperate zone. Beginning at Long-Island on the south, in a region where the finest peaches and many other delicate fruits acquire their most perfect development and flavor, and extending to the provincial line on the north which separates the State from Canada, we have, within these limits, several grades of climate and temperature which are suited to the most important varieties of fruit. The most important belt of country, however, stretches from east to west, beginning at the western line of Massachusetts, and extending to the Great lakes. This belt, which is more than thirty miles wide and but little less than four hundred miles long, includes in its area the best climate in the world for apples, pears, plums, peaches, cherries, and all the smaller fruits. The only exception which it seems necessary to make, is that of the peach, which does not acquire a flavor and taste equal to

those which grow in a longer and warmer summer; still the peach is very fine in some parts of this extensive area, especially in the counties of Cayuga, Genesee, Monroe and Erie. We must not, however, suppose that any of the fruits here named have reached that degree of excellence of which they are susceptible. The public mind has but just awakened to the subject, and we have great reason to expect that fruits, brought under improved modes of cultivation, in favorable circumstances, will acquire qualities much superior to those they now possess.

It is not my purpose to attempt to state in this place the principles upon which the cultivation of fruit is to be conducted. I have alluded to the favorableness of the climate of this State, for the purpose of enforcing the duty of raising crops which have been heretofore considered rather as things convenient than necessary in the family, or at least were not held of that importance which they deserve, or in a just ratio to other farm products. Without doubt all the larger fruits have been held in too low esteem, and as products which could add but a trifle to an annual income. There is a change, however, in the views of farmers, and it is now well established that money can be made in raising good apples and pears; and there is probably no readier way by which a farmer can raise one hundred dollars, than by resorting to the avails of his orchard. It may be supposed by many persons, that as fruit is easily raised, there is much danger that the time will soon come when the markets will be overstocked, and the price of fruit fall below remuneration. There is, however, little danger to be apprehended from this source. The demand has thus far steadily increased with the supply; and the price of fruit of all kinds has rather increased than diminished within the last five years, although the amount brought to market has increased three or four fold.

The history of pomology, for a few years past, has been characterized by the introduction of correct views in regard to the cultivation of fruit; and these views may be well referred to as omens of good. These views respect the quality of fruits, rather than the quantity, and there is a determination to discourage the cultivation of every thing which is inferior. In this fact we have an assurance of improvement in those fruits which are now ranked in the first class of excellence. In the western and middle counties, the tendency of fruit of all kinds is to become large: this result diminishes their high flavor. If this tendency can be counteracted, we have reason to believe that the flavor and taste will be particularly improved. We have yet to learn how far the qualities of fruit can be improved by culture. It is easier to produce a growth of large fruit, than to improve its qualities; still I believe that the latter result is attainable by culture, and that a method will be found which will give a fruit of almost any desirable quality.

To promote results so desirable, it is necessary that a knowledge of our fruits should be more widely extended. Many excellent treatises on this subject have been written, and they have had a wide circulation; but there have been defects in all of them, which has prevented that usefulness they would otherwise have secured. These defects consist in an imperfection of method, in a faulty arrangement, and in a want of that clear and definite description which is so essential to practical works, and without which the objects described

can not be truly determined. There is wanted a classification, particularly for apples and pears, which will put it into the power of any one to determine the name of his fruit. A good method of arrangement is not easily devised, except in large nurseries of fruit, where the numerous kinds may be compared side by side, and their resemblance noted. Deeming classification a matter of great importance, I have sought out, or have tried to seek out, one which will supply, at least in part, what is so much desired.

Before we can obtain a correct notion of a classification, it is necessary that we should possess a knowledge of many individuals. In the classification of varieties, it is generally supposed that a real basis for a classification is wanting; that there is a gradation so close and imperceptible that the lines of demarcation can never be drawn between them. This notion is not entirely true : it is not true in its length and breadth. On the contrary, we may be assured by observation, that in the separation of varieties there are spaces of measurable length, through which our dividing lines may be drawn, and between which there will be found individuals whose resemblance will show very marked affinities. Species are evidently broken up into varieties under or by influences which are perfectly analogous to what takes place in the breaking up of classes into families or orders. For proof of the truth of this statement, look at what has taken place in the domesticated animals : dogs and horses, the ox and sheep, swine, poultry, etc. etc.; and even man himself is an important instance. This law of the breakage of species is the more clear and apparent, the higher the animal ranks in the scale of organization. Assuming the latter assertion as true, and applying it to the vegetable kingdom, we see that fruit trees having the analogies of some of the orders of the animal kingdom, may be expected, like them, to break up into equally distinct kinds. Observation indeed shows this, and especially in those kinds which are susceptible of an indefinite multiplication.

I do not, however, propose to carry to an extreme, views so much allied to those which are purely speculative. All that I wish to show is, that varieties may be classed on principles closely allied to those which are employed in classifying the main divisions of either of the kingdoms of nature. It must be observed, in classifying fruits, that it is only an artificial method : it is the only one which our present knowledge will enable us to use. There is, however, discernable an attempt to create families among the varieties of fruits This is clearly seen in the apples; for instance in the spitzenbergs, pearmains and russets. But it is extremely difficult to put together these families; and hence, for the present, it is probable we shall be obliged to employ an artificial instead of a natural method.

There are two classes of characters which I believe may be employed for the division of apples into convenient sections, viz, color and proportions. Color, though it often appears changeful, fleeting and uncertain, yet in many cases may be relied upon for divisional lines. In apples, red, yellow, green and gray are predominant. The yellow is a ground color, upon which we frequently find red stripes implanted, or a blush of carmine or orange painted. Upon the greens, we usully find a brown intsead of carmine or orange. A yellow fruit rarely if ever varies, and becomes striped or red; and an apple with a blush of carmine never changes this arrangement, so as to become striped with carmine.

The other character, proportion, is as unchangeable in varieties as in species. These proportions relate to the height and breadth, and the comparative width of the ends. When the breadth and height are nearly equal, the fruit appears elongated, as in the Gilliflower and Yellow Bellefleur. On the contrary, when the fruit is round, and especially when shortened, the width very much exceeds the length, but the ends may be equal or unequal. The proportions must be determined by measurement. The eye will, it is true, detect the characters of the extremes, but will be deceived in many instances as it regards height and breadth.

By the employment, then, of these characters which I have briefly considered, I propose to arrange the apples into classes and orders; taking, however, the season of ripening as the basis of the first general division. According to this scheme, this fruit will be arranged in the following manner:

I. SUMMER APPLES.

Class I. *Fruit red and striped or mottled, or splashed with red.*

Order I. Height and breadth equal or subequal.		Order II. Breadth greater than the height.	
A. Ends equal or subequal.	B. Ends unequal.	A. Ends equal or subequal.	B Ends unequal.
Tetopsky. American Summer Pearmain.	American Summer Pearmain. Sops of Wine. William's Favorite. Red Calville. Longville's Kernel.	Borovitsky. Benoni. Cole. Garden Royal. B. Ends unequal. Devonshire Quarenden. Red Astracan. Summer Queen. Summer Rose. Early Pennock. Early Strawberry.	Bevan. Irish Peach. Early Red Margaret. Red Shropshire Vine. Striped Shropshire Vine. River. Foundling. Monamet Sweeting. Belzer. Early Joe. Early Chandler. June Apple, Virg. Summer Hagloe.

Class II. *Yellow, or yellow with an orange or red blush; green, or green with a brown or reddish brown blush.*

Order I. Height and breadth equal or subequal.		Order II. Breadth greater than the height.	
A. Ends equal or subequal.	B. Ends unequal.	A. Ends equal or subequal.	B. Ends unequal.
	Sugarloaf Pippin. Spring-grove Codlin. Dr. Helsham's Pippin. Revelston Pippin. Queen Ann Apple. Summer Belleflower.	Early Harvest. Early Bough. Oslin. High-top Sweeting. Spice Sweeting? B. Ends unequal. Drap d'Or. Early Julien. George Apple.	Lyman's Large Summer. Sine-qua-non. Summer Golden Pippin. Tucker. Golden Sweet. White Juneating. White Astracan. Buffington's Early. July Branch. Cole's Quince. May Apple, Vir.

Class III. *Russets and semi-russets.*

Order I. Height and breadth equal or subequal.		Order II. Breadth greater than the height.	
A. Ends equal or subequal.	B. Ends unequal.	A. Ends equal or subequal.	B Ends unequal.
			Russell's Sweet Russet.

II. AUTUMN APPLES.

Class I. *Red, striped with red, or mottled and splashed with red or brown.*

Order I. Height and breadth equal or subequal.		Order II. Breadth greater than the height.	
A. Ends equal or subequal.	B. Ends unequal.	A. Ends equal or subequal.	B. Ends unequal.
Westfield Seeknofurther. Autumn Strawberry. Striped Holland Pippin. William's Pippin ? Hall's Seeknofurther.	Grand Sachem. Jersey Sweeting. Kilham Hill? King of Pippins. Red Ingestrie. Race's Red. Summer Pearmain. Duke of Beaufort's Pippin. Mark's New Strawbery. Scarlet Pearmain. Virginia Sweeting.	Rambo. Blenheim Pippin. Beauty of the West. Kerry Pippin. Nonsuch. Rambour Franc. Cornish Aromatic. Red Ingestrie. Devonshire Quarenden. Cole Apple. Hurlburt Apple. Summer Wine. Berecourt Pippin. Calville Rouge de Micoud. Christie's Pippin. Cobham Apple. Catline.	Gravenstein. Lyscom. Alexander. Beauty of Kent. Hoary Morning Apple. Longville Kernel. Summer Pearmain. Galway Red. Frank Rambour. Sops of Wine. 20-ounce Pippin. Fall Strawberry. Hurlburt Seedling. White Vandervere. Duchess of Oldenburgh. Flower of Kent. Kenrick's Autumn. Longville's Kernel. Peachpond Sweet. Pomme de Neige. Late Strawberry. Cooper Apple.

Class II. *Yellow, or yellow with orange red blush, or green with a brown blush.*

Order I. Height and breadth equal or subequal.		Orler II. Breadth greater than the height.	
A. Ends equal or subequal.	B. Ends unequal.	A. Ends equal or subequal.	B. Ends unequal.
Kirk's Golden Pippin. Mank's Codlin?	Franklin's Pippin. Keswick Codlin. Old English Codlin. Porter. Yellow Ingestrie. Seeknofurther (Coxe's). Stroat. Alfriston. Gray Pippin. Gray Leadington. Jubilee Pippin. King of the Pippins. Warren Pippin.	Downton Pippin. Dyer. Golden Sweet. Hawthornden. Maiden's blush. Summer Sweet Paradise. Wormsley's Pippin, or Knight's Codlin. Kerry Pippin. Northern Golden Sweet. Seedling Newtown Pippin. Hewe's New Golden Pippin. Oake's Apple. Philadelphia Pippin. Wyken's Pippin. Cooper's Redling. French Pippin.	Fallawater. Ridged Pippin. Spanish Pippin. Potter's Large Apple. Summer Broaden. Waltham Abbey Seedling. Nelson Codling. Rymer Apple. Transparent Codlin. Gloria Mundi. Hawley. Fall Harvey. Dutch Codlin. Fall Pippin. Holland Pippin. Lyman's Pumpkin Sweet.

Class III. *Fruit russet or semi-russet.*

Order I. Height and breadth equal or subequal.		Order II. Breadth greater than the height.	
A. Ends equal or subequal.	B Ends unequal.	A. Ends equal or subequal.	B. Ends unequal.
	Pumpkin Russet. Pine-apple Russet. Dowell's Pippin. Cheeseborough Russet. Early Nonpareil.	Radley's Pippin. Scarlet Crofton. Braddock's Nonpareil.	Ross's Nonpareil. Bowyer's Russet. Pitmaston Russet.

III. WINTER APPLES.

Class I. *Fruit striped, mottled or splashed with red or brown.*

Order I. Height and breadth equal or subequal.		Order II. Breadth greater than the height.	
A. Ends equal or subequal.	B. Ends unequal.	A. Ends equal or subequal.	B. Ends unequal.
Mother. Buek Meadow Apple. Pennock's Red Winter.	Bailey's Sweet. Kaign's Spitzenburgh. Winter Pearmain. Newark King. Red Bellefleur. Jonathan. Minister. Sweet Pearmain. Black Gilliflower. Cornish Gilliflower.	[*None.*] B. Ends unequal. Doctor. Hoary Morning. Kentish Fillbasket. Murphy. Rockremain. Pound. Golden Reinette. Hartford Sweeting. Newtown Spitzenburgh. Watson Dumplin. Wine Apple. Campfield. King Apple. Court Pendu. Hubbardton's Nonsuch. Richfield Nonsuch. Black Detroit. Phillips' Sweeting. Sweet Baldwin. Black Apple, of Coxe. Carthouse. Eustis. Limber Twig. Luscombe's Seedling. Marston's Red Winter. McLellan. Pryor's Red. Winter Queen. Chandler. Apple of the Well. Cornish Gilliflower. Domine. Wine Sap. Mark's New Spitzenburgh. Margil.	Blue Pearmain. Stevens' Gilliflower. Westfield Seeknofurther. Red Calville. Cos, or Caas. Northern Spy. Herefordshire Pearmain. Claygate Pearmain. Flushing Spitzenburgh. English Sweeting. Red Raunce. Blenheim Pippin. Court of Wick. Priestly. Black Apple. Golden Reinette. Dutch Mignone. Barcelona Pearmain. Borsdorffer. Vandervere. Brabant Bellefleur. Wagener. Winter King. Redstreak. Monmouth Pippin. Baldwin. American Pippin. Esopus Spitzenburgh. Melon. Ribston Pippin. Fameuse. Ramsdel Sweeting. Red Gilliflower. Ladies' Sweeting. Kirke's Lord Nelson. Willow Twig. Ohio Nonpareil. Stannard's Seedling.

CLASS II. *Fruit yellow or yellow with an orange blush, green or green with a brown blush.*

ORDER I. Height and breadth equal or subequal.		ORDER II. Breadth greater than the height.	
A. Ends equal or subequal.	B. Ends unequal.	A. Ends equal or subequal.	B. Ends unequal.
Salisbury's Winter. Warren Pippin.	Yellow Bellefleur. White Bellefleur. Michael Henry. Cornish Gilliflower. Waxen Apple. Lowell. Lemon Pippin.	French Pippin. Canada Pursemouth.	Beachamwell Seedling. Cockle Pippin. King of the Pippins. St. Julien. Golden Ball. Harrison. Ord's Apple. Seedling Newtown Pippin. Pearson's Plate. White Spanish Reinette. Swaar. Newtown Spitzenburgh. Tewksbury Winterblush. Victuals and Drink. Styre. Court Pendu. Cranberry Pippin. Easter Pippin. Fenouillet Rouge. Lady Apple. Norfolk Beaufin. Rhode-Island Greening. Wells Sweeting. McLean's Favorite. Green Sweet. Old Town Crab. Fort Miami. Loudon Pippin. Pickman. Sweet and Sour. White Seeknofurther. Winter Cheese. Leicester Sweeting. Moore's Late Sweet. American White Winter Calville. Shawmut. Orange. Norfolk. Table Greening.
		B. Ends unequal. Cann. Cumberland Spice. Aunt Hannah? Golden Pippin. Yellow Vandervere. Winter Queen. Woolman's Long. Marble Carle. Mouse. Reinette Canada. Nonpareil. Court of Wick. Downton Pippin. Fallawater. White Vandervere. Yellow Newtown Pippin. Green Newtown Pippin. Peck's Pleasant. Victorious Reinette. Sturmer's Pippin. Winter Sweet Paradise. White Pippin. Western Spy. Dumilow's Seedling. Wood's Greening? White Calville. Catshead. Bedfordshire Foundling. Danvers Winter Sweet. Fenouillet Jaune. Roman Stem. Surprise. Talman Sweeting. Paradise Pippin.	

CLASS III. *Fruit russet or semi-russet.*

ORDER I. Height and breadth equal or subequal.		ORDER II. Breadth greater than the height.	
A. Ends equal or subequal.	B. Ends unequal.	A. Ends equal or subequal	B. Ends unequal.
Aromatic Russet? Knobby Russet. Siely's Mignone. Cooper's Russeting.	Farmer's Crab Apple. Ashmead's Kernel. Brodwell.	[*None.*]	White Russet. Jersey Crab. English Russet. Bourassa. Golden Harvey. Cornish Aromatic. Morton's Nonpareil. Ross's Nonpareil. Royal Russet. Hughes's Golden Pippin. Gray French Reinette. Yellow Vandervere. Pomfret Russet. Horsham Russet. Patch's Russet. Pennington Russet, or Seedling. Pile's Russet. Pitmaston Russet. Scarlet Nonpareil. Sweeney's Nonpareil.
		B Ends unequal. Red Russet. Win Russet. Sweet Russet. Pomme Grise. Fenouillet Gris. Golden Harvey. Old Nonpareil. Golden Russet. Boston Russet. Sam Young. Shippen's Russet. Skyehouse Russet. American Golden Russet. Acklam's Russet. Pine Apple Russet. Powell's Russet. Reinette de Hongrie. Wheeler's Russet.	

CHAPTER II.

VARIETIES OF THE APPLE.

I. SUMMER APPLES.

SYNOPSIS OF THE VARIETIES.

CLASS I. *Fruit mostly red or carmine; or yellow, with red, carmine, or reddish brown stripes.*

ORDER I. Height and breadth equal or subequal.

A. Ends equal or subequal.

TETOPSKY?

B. Ends unequal.

†AMERICAN SUMMER PEARMAIN*. Ends subequal. Fruit medium size.

EARLY RED MARGARET. Ends quite unequal. Below the medium size.

†SOPS OF WINE. Ends subequal. Below the medium size.

WILLIAM'S FAVORITE. Fruit medium size, unsymmetrical.

†RED CALVILLE. Ends quite unequal. Medium size. Crown ridged.

†LONGVILLE'S KERNEL. Ends subequal. Medium size.

---

* The fruits marked thus † ripen late in summer, and early in autumn; or if autumnal fruits, they ripen late in autumn, and continue into early winter. The season in which they first ripen determines the general division in which they are placed. Variations of this kind form some of the difficulties which attend an orderly arrangement of fruits.

In order to fix upon a uniform mode for determining the equality of the ends, and of the height and breadth, I propose to draw three lines as in figures 1 and 2 (see next page): the first, a line through the apple from side to side, touching the point of junction of the stem with the flesh; the second, through the crown, touching the apex of the calyx; and the third at right angles to the two already described, which determines the height of the fruit.

The same varieties of fruit preserve a great uniformity between their proportional lines, as appears from the figures just referred to. Fig. 1 is the outline of a Newtown Pippin, grown in New-Jersey; and fig. 2, the outline of the same kind of pippin, raised in Western New-York. The stem of the Jersey apple is longer, but the lines representing the proportions of the ends are quite equal. These lines should always be measured with the rule, as the eye is liable to be deceived, particulary in elongated apples, such as the Bellefleur and Black Gilliflower; the height appearing to be much greater than the breadth, whereas in fact they are about equal.

ORDER II. Breadth greater than the height.

B. Ends unequal.

BOROVITSKY. Fruit angular, medium size. Stripes faint.

BENONI. Fruit medium size. Skin deep red.

COLE. Fruit above the medium size, angular.

Fig. 1.

The line *a a* (fig. 1) is drawn through the base, at the junction of the stem with the flesh at the bottom of the depression; and *b b* is a line drawn through the crown, at the bottom of the calyx depression. When this depression is very shallow, the end is narrow, although it may speedily widen, and the two extremities may appear at first sight subequal: so when the stem depression is shallow, this end is often very narrow, especially when the depression is filled up, or obsolete. These proportions, I believe, will be found very important in determining the names of fruit; but as they have not as yet received much attention, it is impossible to make use of them except when an outline figure is given: these should be drawn with great care from the fruit itself.

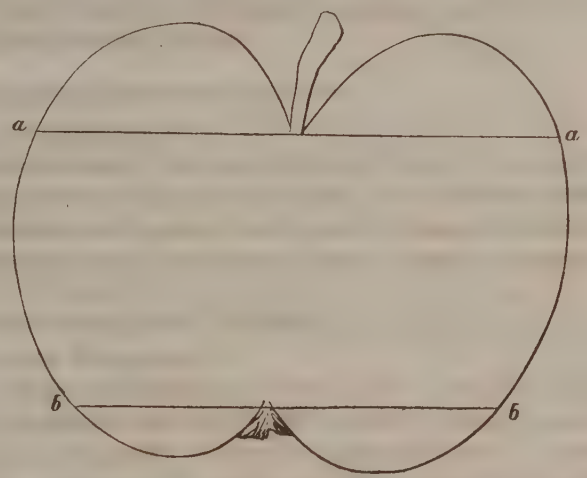
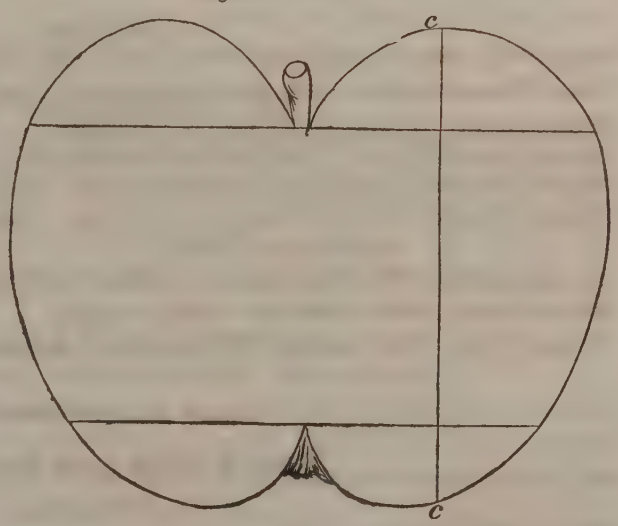


Fig. 2.

In figure 2, the line *c c* represents the height of the apple, and, like the lines representing the breadth at the extremities already referred to, will be found quite constant in its relations in the same varieties, although produced in different sections of this country. If this is not true, we may despair of describing fruit so as to become useful to inquirers.



Early Strawberry. Fruit below the medium size. Stem long. Stripes on a white ground.
Early Red Margaret. Fruit below the medium size. Stem short and thick.
Red Astracan. Fruit rather above the medium size. Stem short, inserted in a deep depression.
Summer Queen. Fruit rather above the medium size. Stalk long, inserted in a deep depression. Base broad or wide.
Early Pennock. Above the medium size. Base very broad. Calyx end or crown comparatively narrow.

Class II. *Color yellow or greenish red. Cheek, if colored, suffused with an orange blush or crimson, without stripes.*

Order I. Height and breadth equal or subequal.

B. Ends unequal.

Sugarloaf Pippin. Ends quite unequal. Depression deep.
†Spring-grove Codlin. Ends quite unequal. Calyx depression oblique, plaited. Juice acid.
†Doctor Helsham's Pippin. Fruit medium size, angular. Juice sweetish.
Revelstone Pippin. Fruit medium size. Calyx depression knobbed. Juice sweet.

Order II. Breadth greater than the height.

A. Ends equal or subequal.

Early Harvest. Fruit above the medium size, round. Calyx set in a shallow basin.
Lyman's Large Summer. Fruit above the medium size, flattened.
Oslin. Fruit below the medium size. Stem short, thick, and set in a shallow depression.
High-top Sweeting. Medium size. Stem slender. Skin sprinkled with white dots. Color yellowish green.

B. Ends unequal.

†Drap D'Or. Fruit medium size. Stem short. Calyx depression shallow, plaited.
Large Yellow-bough. Fruit above the medium size, and sweet.
Sine-qua-non. Fruit medium size, roundish-ovate.
Summer Golden Pippin. Fruit below the medium size. Stem short, set in a wide depression.
White Juneating. Fruit below the medium size. Stem long. Both depressions shallow.
White Astracan. Fruit medium size, subconical. Stem short and thick. A few faint red stripes upon the cheek.
Red Quarenden. Fruit medium size. Colored with light and deep crimson, without stripes.
Early Julien. Fruit middle size. Sides angular.
George Apple. Medium size. Skin sprinkled with russety dots, pale yellow.

Class III. *Fruit russet.*

Order II. Breadth greater than the height.

B. Ends unequal.

Russel's Sweet Russet. Sweet, semi-russet. Skin warted.

DESCRIPTION OF SUMMER APPLES.

Class I. *Red striped fruit.*

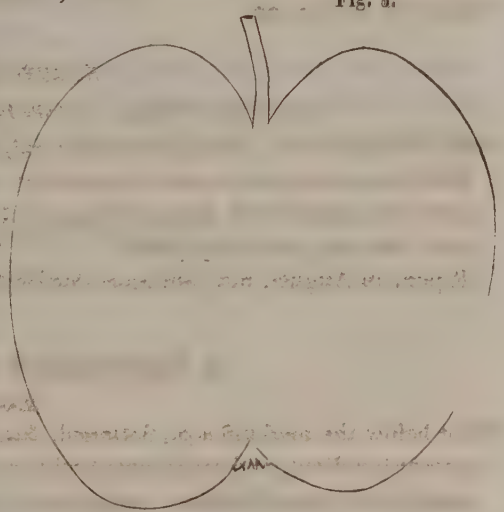
Order I. Height and breadth equal or subequal.

B. Ends unequal.

1. AMERICAN SUMMER PEARMAIN (*Thompson*).

Early Summer Pearmain, Coxe.

Fig. 3.



Fruit medium size, tapering moderately from the base to the crown, circular. Skin spotted with yellow and red on the shaded side, and striped with lively red and yellow upon the sunny side. Stem ¾ inch long, set in a deep depression. Calyx set in a deep depression. Flesh yellowish and tender. Flavor rich and pleasant.

A New-Jersey Apple, supposed by Mr. Downing to have been produced from a seed of the English Summer Pearmain. It grows well on sandy soils.

2. EARLY RED MARGARET (*Thompson, Lindley*).

Red Juneating. Margaret or *Striped Juneating*, Ronalds. *Early Red Juneating. Eve Apple* of the Irish. *Striped Juneating. Margaretha Apfel* of the Germans.

Fruit slightly below the medium size, round-ovate, tapering from the middle to the crown, circular: base much greater than the crown. Stem thick, short, subequaling the base, and set in a rather deep depression. Calyx set in a small shallow depression. Flesh white and subacid: flavor rich, pleasant and agreeable.

This apple ripens in July. The tree is slender, and is a moderate bearer.

3. SOPS OF WINE (*Lindley, Ross*).

Sops in Wine, Ray, 1688. *Rode Wyn Apfel*, Knoop. *Sapson*, Kenrick.

Fruit below the medium size, globular, tapering from the middle to the crown, fair, circular, crimson, striped on the sunny side with purplish crimson, and covered with a delicate white bloom. Stem slender. Flesh white and stained with a pinkish hue, juicy and crisp: taste subacid: flavor pleasant.

This fruit lasts till October: and though not regarded as one of the best, yet its beauty and qualities combined make it deserving of cultivation.

4. WILLIAM'S FAVORITE (*Manning*).

Fruit above the medium size, unsymmetrical or one side more perfectly developed than the other, oblong. Stem rather long and slender, and set in a shallow depression. Calyx set in a narrow angular depression, with the leaves connivent. Fair with a smooth skin, light red, but deepened upon the sunny side. Flesh yellowish : taste subacid and agreeable.

It is supposed to have originated in Roxbury, Massachusetts. It bears well, and its fruit is in eating from the last of July to the first of September. It is recommended as well worthy of cultivation.

5. RED CALVILLE.

Calville d'Eté, DUHAMEL. *Calville Rouge d'Eté,* No. 131 Lond. Hort. Soc. Cat.

Fruit medium size, elongated : sides ridged : crown narrow and ridged. Stem short, thickish, and set in a rather deep cavity. Calyx set in a narrow ridged depression. Skin pale red, shaded with deeper stripes on the sunny side. Flesh white, slightly tinged red next the core, not very juicy.

Ripens in August, but continues into September in England.

6. LONGVILLE'S KERNEL (*Thompson*).

Sam's Crab.

Fruit below the medium size, flattened. Stem short, inserted into a deep excavation. Color greenish yellow, and ornamented with pale brown and reddish stripes. Fruit inferior to many well known kinds. August and September.

ORDER II. Breadth greater than the height.

B. Ends unequal.

7. BOROVITSKY (Lond. Hort. Soc. Cat. No. 94).

Fruit of a medium size, and angular. Color on the shaded side pale green, but ornamented on the sunny side with crimson red stripes. Stem rather long, and set in a rather deep wide depression. Calyx placed in a deep plaited depression. Flesh white, firm, juicy, and ripe by the middle of August.

It is of Russian origin, as its name implies. It is regarded as a valuable apple.

8. BENONI.

Fruit of a medium size, round. Color deep red. Flesh yellowish and tender. Taste agreeably subacid. Ripens in August.

Originated in Dedham, Mass.

9. EARLY WOOLMAN.

Woolman's Harvest. Summer Rose.

Fruit rather less than the medium size, roundish, circular. Calyx closed, and surrounded by an even depression. Stem slender, short. Color waxen yellow, blazed with carmine on the sunny side.

August. A valuable apple, and recommended by our distinguished pomologist DAVID THOMAS.

10. COLE (*Thompson, Lindley*).

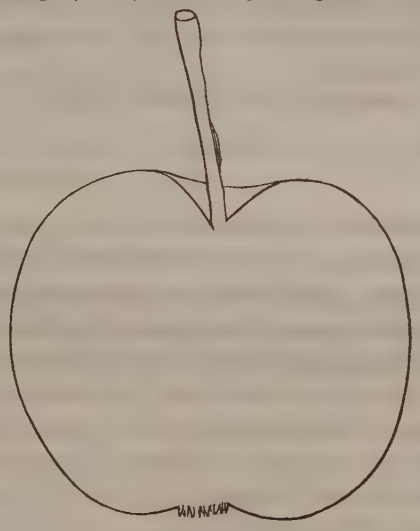
Scarlet Perfume.

Fruit of a medium size, roundish, slightly angular and depressed, red or crimson, upon a yellow ground. Stem long, woolly, and set in a very narrow cavity. Calyx large and enclosed in a wide depression. Flesh white, firm, juicy. Taste agreeable, and accompanied with a rich flavor. August.

11. EARLY STRAWBERRY (*Downing*).

American Red Juneating.

Fig. 4.



Fruit rather below the medium size, roundish: crown much narrower than the base, circular. Stem very long, set in a regular and rather shallow depression. Calyx rather small, and surrounded by a shallow depression. Color red, and ornamented with crimson stripes. Flesh white and tinged red next the skin, tender, subacid, lively with a spirited aroma.

This apple is common in our markets, and is probably the best of the early ones. It is ripe by the middle of July.

12. EARLY RED MARGARET.

Fruit less than the medium size, roundish ovate: crown narrow, but full and large between it and the middle, circular. Stem short, thick, and set in a rather deep depression. Calyx surrounded by a very shallow plaited depression. Color red upon a greenish yellow ground, and ornamented with fine crimson stripes. Flesh white, subacid and agreeable. Middle of July.

It is an excellent apple, but the tree is a small bearer. It differs in form from the Strawberry, and in the length of stem and relation of the height and breadth; the latter being proportionally wider, and more depressed.

13. RED ASTRACAN (*Thompson, Lindley*).

Fruit full medium or a little above medium size, fair, smooth and circular, depressed, and but little narrower at the crown than at the base. Stem short and rather thick. Calyx rather large, and both depressions large and deep. Color deep carmine, with only traces of the yellow ground, and some russet near the stem and surface, suffused with a rich bloom like that of the plum. Flesh white, crisp and juicy : taste acid and agreeable.

This apple was imported into England from Sweden, and from the former country here. It is a splendid specimen of table fruit, and is truly worthy of cultivation. It is also strictly a summer apple, ripening between the last of July and the middle of August.

14. SUMMER QUEEN (*Coxe*). PLATE 75, fig. 1.

Fruit large, with a wide base, from which it tapers to the crown. Color red in stripes upon a fine deep yellow ground. Stem long, and inserted in a deep narrow depression. Ripe in August.

A beautiful and excellent apple.

15. EARLY PENNOCK.

Fruit above the medium size. Stem about one inch long, set in a deep somewhat irregular depression. Calyx medium size, and surrounded by a narrow basin and tolerably high crown. Base wide, and increasing in width to the middle, from which it tapers rapidly to the crown. Color greenish yellow : sunny side dashed with red or carmine. Flavor subacid and pleasant, juicy. Flesh yellowish. Skin smooth.

The apple varies in size. Its remarkable width at the middle, and its taper to the crown, giving it the appearance of a wide low pyramid, is somewhat characteristic. It ripens in Ohio by the 10th of August. Described in Transactions of the Ohio Nurserymen and Fruit-growers Convention in 1847. It is regarded only as a second rate apple for eating, but excellent for cooking.

CLASS II. *Yellow and green fruits; or if red, the color is a suffused orange or carmine on the sunny side, without stripes.*

ORDER I. Height and breadth equal or subequal.

B. Ends unequal.

1. SUGARLOAF PIPPIN.

Sugarloaf Pippin, Lond. Hort. Soc. Cat. No. 1078. *Dalgoi Squozinoi*, No. 254 Lond. Hort. do.

Fruit medium size. Base rather wide, from which it tapers to the crown, in which the excavation is rather deep and plaited: plaits few. Stem rather long, and inserted into a deep, rather wide, regular depression. Color light yellow on both sides, and becoming rather white when ripe. Skin marked with a few greenish dots. Flesh white, firm, crisp and juicy, with a sweetish subacid flavor.

An excellent August apple, but keeps only about ten days. Supposed to be of Russian origin.

2. SPRING-GROVE CODLIN.

Spring-grove Codlin, Lond. Hort. Trans. Vol. i. p. 197.

Fruit of the medium size, elongated, but the diameter greater than the height, slightly angular: crown narrow: depression narrow, oblique and plaited. Stem short. Color pale greenish yellow, with an orange cheek on the sunny side. Flesh greenish yellow, tender, with a saccharine juice and an aromatic perfume.

This apple is honored with an introduction to the London Horticultural Society, from the celebrated Sir JOSEPH BANKS, in 1810.

3. DOCTOR HELSHAM'S PIPPIN.

Fruit middle size, higher than wide, slightly angular and conical: crown narrow: depression oblique and rather wide. Color yellowish, with a clear blush of carmine, without stripes on the sunny side. Stem rather long, and inserted in a deep depression. Juice sweet, with some aroma.

August and September. Branches of the tree drooping. Apple originated in the county of Norfolk, England.

4. REVELSTONE PIPPIN (Lond. Hort. Trans. Vol. iv. p. 522).

Fruit somewhat angular, and of the medium size: angles or ribs running into the calyx depression, and terminating in small knobs. Stem short, thick, inserted into a round smooth depression. Color greenish yellow, the sunny side suffused with a carmine blush without stripes. Skin dotted with russety spots. Flesh yellow, firm, dry, but attended with a good flavor.

August and beginning of September. Decay rather rapid.

ORDER II. Breadth greater than the height.

A. Ends equal or subequal.

5. EARLY HARVEST (*Thompson*).

Prine's Harvest. Early French Reinette, COXE. *July Pippin,* HOY. *Yellow Harvest. Large White Juneating. Tart Bough.*

Fruit round and large, circular. Color yellow. Depressions shallow, especially the crown; the basal depression embraces a stem about half an inch long. Flesh white, tender, juicy, subacid and agreeable.

This is one of the best American apples for the table, and for cooking. It ripens in July (by the first in the lower counties of New-York, and by the middle in New-England), and continues in use till near the middle of August.

6. OSLIN.

Arbroath Pippin, FORSYTH.

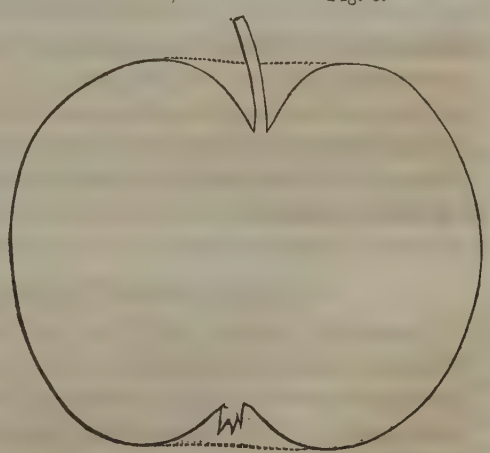
Fruit of the medium size, depressed, circular. Color lemon-yellow, mingled with bright green. Depression shallow; the crown plaited prominently. Stem short and thick. Flesh yellowish and crisp, juicy and spicy.

Apple of Scotch origin, ripening in August.

7. HIGH-TOP SWEETING (Old Plymouth Colony).

Summer Sweet, Marietta, Ohio.

Fig. 5.



Fruit of the medium size or rather less, circular, fair. Color yellowish green, spattered with white dots. Stem slender and rather long, and set in a deep basin. Calyx closed, and set in a shallow depression. Flesh sweet, tender, juicy, free from astringency.

Tree thrifty and upright. Ripens from the middle of July to August. It is regarded with favor both at the East and West.

B. Ends unequal.

8. DRAP D'OR.

Vrai drap d'Or, DECH. *Late Summer Pippin. Bay Apple* and *Bonne de Mai*, THOMPSON. *Hudson Summer Pippin* of some writers.

Fruit large, roundish, narrowing from the base to the crown. Skin smooth, fair, of a gold color, and marked with distinct brown specks. Stem short, and moderately sunk in the depression. Crown surrounds a shallow basin whose form is irregularly plaited. Flesh crisp and juicy, pleasant.

9. SUMMER GOLDEN PIPPIN (*Thomson, Lindley*, P. Mag.).

Fruit below the medium size, ovate, compressed at the crown, whose depression is rather wide and shallow. Color bright yellow, suffused on the sunny side with an orange blush. Flesh yellowish, firm, crisp.

This apple is considered by DOWNING as inferior to many others which ripen in August.

10. WHITE JUNEATING.

Fruit below the medium size, roundish, circular : depressions shallow. Stem long and slender. Color first greenish, then yellow, and finally the sunny side has a faint blush. The flesh is crisp and pleasant.

The apple ripens early in July, and is an excellent bearer. Very good, but not regarded as the best.

11. WHITE ASTRACAN.

White Astracan, THOMPSON, LINDLEY. *Pyrus Astracanica, Transparent Muscovie, Glace de Zelande* of the French gardeners.

This apple is not regarded as worthy of cultivation. It is conical, somewhat ribbed on the sides, and also in the depression of the crown. Skin smooth, white, with a white bloom and a few faint stripes of red. Flesh white, tender, rather dry, and disposed to become mealy and water-cored. Ripens early in August.

12. RED QUARENDEN (*Lindley*).

Sack Apple.

Fruit scarcely reaching the medium size, roundish ovate, flattened and slightly narrowed at the crown, which has a very shallow depression. Color subcarmine, with a roundish spot of green on the sunny side, and dotted with green.

Ripens early in August, and continues into September. It is a fine desert apple, and nearly equals in beauty the Red Astracan.

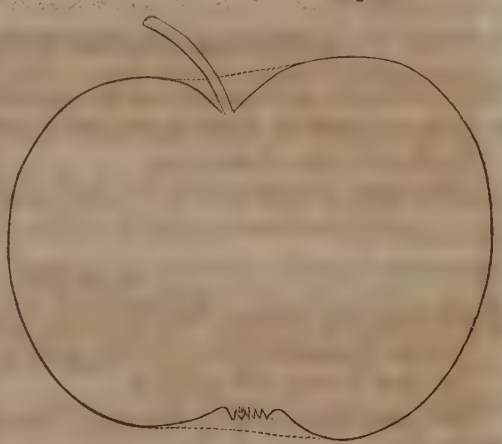
13. EARLY JULIEN (Lond. Hort. Trans.).

Fruit medium size, angular or ribbed : ribs continued into the borders of the crown depression, where they terminate in prominences. Color pale yellow. Flesh yellow, firm and crisp. Flavor brisk and pleasant, and superior to most of the August apples.

It is of Scotch origin, and is a good dessert fruit.

14. GEORGE APPLE (Ohio Nurserymen and Fruit-growers, 1848).

Fig. 6.



Fruit of the medium size, circular, slightly depressed and uniform. Stem slender, rather long, and set in a wide and rather shallow depression. Calyx surrounded by a low crown or summit, or rather enclosed in a shallow wide depression. Color pale yellow. Skin sprinkled with numerous small russety spots. Flesh subacid, whitish, juicy and firm.

It is regarded with favor, but being a seedling, and as yet but little known, its reputation is not established. Ripens in July – August. It is an Ohio apple, and originated in the orchard of Mr. George, of Muskingum county, Ohio.

15. QUEEN ANNE APPLE (*Elliott*).

Fruit above the medium size, oblong or elongated, subangular, tapering from the middle to the crown. Stem slender, of a medium length, and set in a rather deep narrow basin. Calyx set in a deep depression, and surrounded by a narrow crown. Color bright yellowish green. Skin sprinkled with white specks. Flesh yellowish, tender, and possesses a rich subacid flavor.

Ripens by the middle of August, and continues until the middle of September, but may be kept till December. The tree is strong and thrifty : wood dark brown. A free and early bearer.

I perceive this apple has been referred to the Lowell apple, or Middle apple of Oneida county, by J. J. Thomas. It is proper to say, that the apple known here under the name of Lowell apple is quite different. It is figured on Plate 40; and although the form and color agree, still the one figured is not ripe till February, and will keep till quite late in the spring. For this reason I have retained the name Queen Anne, under which it is described by Elliott in the Western Reserve Magazine, p. 145, for September.

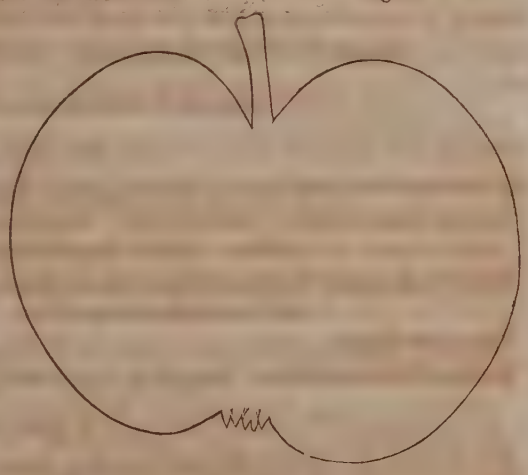
CLASS III. *Russets and semi-russets.*

ORDER II. Breadth greater than the height.

B. Ends unequal.

16. RUSSELL'S SWEET RUSSET.

Fig. 7.



Fruit of the medium size, unsymmetrical. Stem rather stout, of a medium length, and set in a deep depression. Calyx large, and set in a shallow depression. Color pale yellow on a green ground, and on the sunny side a faint blush of red is sometimes formed. A fine and beautiful russet spreads over a large part of the shaded side. Skin warted. Flesh yellow and firm grained, rich, sweet and good.

The tree is robust and strong, and grows with an upright open head. Ripens its fruit in August (see the Transactions of the Ohio Nurserymen and Fruit-growers Convention, p. 15, 1848). The description given of the fruit leads me to entertain a favorable opinion of the apple, and hence I have given it the name of Russell's Sweet Russet, retaining the name of the gentleman who presented the apple.

17. SUMMER QUEEN (PLATE 27, fig. 1).

Summer Pearmain.

Fruit of the medium size, elongated, nearly or quite circular. Stem long, and set in a deep depression. Calyx rather large, and crowning a tube which extends to the core, and which is grown to a plaited depression. Color carmine red, and indistinctly striped upon a yellow ground. Flesh yellowish. Core rather large, the seeds occupying only about a quarter of the space. Flavor rich, aromatic and fine.

This apple grows upon a large tree with pendant branches, and ripens early in August. The apple is quite broad at the base, and tapers considerably to the crown.

18. EARLY JOE (Horticulturist).

Fruit below the medium size, circular and rather flattened, smooth and shining. Stem long, and set in a wide basin. Calyx small, and placed in a shallow depression. Color pale carmine and striped with deeper, which is quite intense when exposed to the full rays of the sun, spotted sparsely with green. Flesh white, tender, juicy: flavor pleasant and agreeable: taste subacid.

The Early Joe is a fine dessert apple, and equal to any in its season. It is a seedling, and originated in Western New-York, in the orchard of OLIVER CHAPIN, East Bloomfield. It was first brought before the public by WILLIAM SMITH of Macedon, in the Horticulturist for February 1847.

II. AUTUMN APPLES.

SYNOPSIS OF THE VARIETIES.

CLASS I. *Fruit red or striped, mottled or splashed with red or brown.*

ORDER I. Height and breadth equal or subequal.

A. Ends equal or subequal.

†WESTFIELD SEEKNOFURTHER. Medium size. Ends subequal.

AUTUMN STRAWBERRY. Medium size. Stripes extend round the whole apple. Crown bright yellow. Width somewhat greater than the height.

STRIPED HOLLAND PIPPIN. Above the medium size, obscurely pentangular. Stem short and set in a shallow depression.

WILLIAM'S PIPPIN.

HALL'S SEEKNOFURTHER. Base of the stem fleshy. Stem recurved. Depression closed.

B. Ends unequal.

GRAND SACHEM. Above the medium size, subangular. Stem short.

JERSEY SWEETING. Fruit medium size. Stem depression narrow. Sweet.

KILHAM HILL. Fruit medium size, roundish, ribbed. Stem long.

KING OF THE PIPPINS. Fruit of the medium size. Stem long and thin. Calyx large and set in a deep depression.

RED INGESTRIE. Fruit of the medium size. Calyx depression wide. Stem short and slender.

RACE'S RED. Medium size. Dark crimson stripes.

SUMMER PEARMAIN. Fruit medium size. Stem short and rather obliquely planted.

DUKE OF BEAUFORT'S PIPPIN. Fruit a little above the medium size, with five prominent ribs.

MARK'S NEW STRAWBERRY APPLE. Full medium size. Calyx prominent. Crimson stripes.

SCARLET PEARMAIN. Fruit of the medium size. Stem set in a deep depression; slender, long. Calyx deep.

VIRGINIA SWEETING. Fruit above the medium size. Stem short.

ORDER II. Breadth greater than the height.

A. Ends equal or subequal.

†RAMBO. Fruit medium size. Stem long and slender; set in a deep wide depression.

†BLENHEIM PIPPIN. Above the medium size. Calyx depression angular, deep and open.

BEAUTY OF THE WEST. Above the medium size. Stem short. Depression round. Sweet.

KERRY PIPPIN. Medium size. Stem short, thickened. Depressions narrow. One or more sharp ridges upon the surface.

†NONSUCH. Medium size, circular. Stem short, subequaling the edge of the crown.

RAMBOUR FRANC. Medium size. Stem short. Calyx deep, in an angular depression.

†Cornish Aromatic. Above the medium size. Crown angular. Stem short. Calyx small, deep.

Devonshire Quarenden.

Cole Apple. Above the medium size. Stem woolly, inserted under a fleshy projection.

Hurlburt Apple. Full medium size.

Summer Wine. Scarcely medium size.

Bere Court Pippin. Medium size. Stem slender, and set in a deep depression.

Colville Rouge de Micoud. Medium size, three or four-ridged. Calyx set in funnel-form depression. (Two crops in a season.)

Christie's Pippin. Medium size, circular. Calyx small. No plaits in the depression.

Cobham Apple. Medium size, subangular. Calyx segments closed. Stem half an inch long, slender.

†Catline. Below the medium size. Stem short and thick.

B. Ends unequal.

Gravenstein. Above the medium size. Stem short and thick. Calyx set in wide and rather deep depression.

Alexander. Above the medium size. Stem three-fourths of an inch long, slender.

Lyscom. Medium size. Stem short. Depression deep and round.

Beauty of Kent. Above the medium size. Crown ribbed. Stem short, slender. Calyx small.

Hoary Morning. Medium size, and bloomed. Calyx quite small; depression narrow and shallow.

Longville Kernel. Medium size, subangular. Stem short, deep. Calyx small; segments short, erect.

Galway Red. Medium size. Stem equaling the crown.

Sops of Wine. Medium size, globular. Crown obscurely ribbed, narrow. Stem long, slender.

†20-ounce Pippin. Much above the medium size. Stem short, thick, and set in a deep depression.

White Vandervere.

Dutchess of Oldenburgh. Medium size. Calyx large; depression even.

Flower of Kent. Medium size, ribbed. Calyx small; depression large, ridged and irregular.

Kenrick's Autumn.

Peachpond Sweet. Medium size. Stem long and slender, subangular.

Fameuse. Medium size. Stem quite slender; depression narrow and funnel-shaped.

Late Strawberry.

Class II. *Yellow, or yellow with an orange red blush, or green, greenish yellow with a brown blush.*

Order I. Height and breadth equal or subequal.

A. Ends equal or subequal.

Kirke's Golden Pippin. Below the medium size, circular. Calyx large, within a flattish crown.

Mank's Codlin. Medium size. Depression shallow, plaited. Stem fleshy.

B. Ends unequal.

Franklin's Pippin. Medium size. Stem slender; depression rather deep. Calyx sunk in an even depression.

Keswick Codlin. Medium size, ribbed, obscurely pentangular. Calyx large and deep. Stem short.

Old English Codlin.

Porter. Medium size, elongated, bright yellow.

Yellow Ingestrie.

Seeknofurther (Coxe's).

Stroat.

Alfriston. Above the medium size, ribbed. Calyx deep, and depression rigid and irregular. Stem short, deep.

Gray Pippin. Below the medium size, subangular. Calyx small; depression regular. Stem short, deep.

Gray Leadington. Above the medium size, pentangular. Calyx large, deep. Stem medium, thick.

Jubilee Pippin. Above the medium size. Ribs irregular. Crown narrow, angular. Calyx small, deep; depression compressed. Stem short.

Warren Pippin.

Order II. Breadth greater than the height.

A. Ends equal or subequal.

Dyer.

Golden Sweet.

†Hawthornden. Above the medium size; form irregular. Sometimes a single prominent rib. Stem slender, deep. Calyx small; deep depression, with obtuse plaits.

Maiden's Blush. Medium size, depressed. Fine crimson cheek.

Summer Sweet Paradise.

Wormsley's Pippin. Medium size, subangular. Calyx deep; depression plaited. Stem long, deep.

†Baltimore Apple. Very large. Calyx large, open; depression plaited. Stem short.

Northern Golden Sweet.

Seedling of the Newtown Pippin. Medium size. Late fall apple.

Hawe's New Golden Pippin.

Oakes's Apple. Medium size, irregular. Two or more ribs. Calyx deep. Stem very short, thick; depression narrow.

†Philadelphia Pippin. Above the medium size. Calyx small. Stem half an inch; medium depth.

Wyken's Pippin. Below the medium size. Depression of the calyx shallow. Stem short, shallow.

Cooper's Redling.

French Pippin.

B. Ends unequal.

Fallawater.

Ridged Pippin.

Spanish Pippin.

†Potter's Large Apple. Above the medium size, very large. Angles large and obtuse. Calyx large, deep; depression wide, plaited. Stem long, deep.

Summer Broaden. Above the medium size. Calyx small, closed. Stem short, slender, deep.

†Waltham Abbey Seedling. Medium size. Calyx large, open; depression shallow, even. Stem short, deep.

Nelson Codlin. Medium size, subangular. Crown narrow. Calyx small, closed; depression narrow, plaited.

†Rymer Apple. Above the medium size; form irregular. Ribs broad, prominent at the crown. Stem subequal. Calyx open, deep; depression oblique, angular.

Transparent Codlin. Medium size. Crown elongated. Calyx closed, deep; depression angular. Stem short, slender, deep.

Gloria Mundi. Above the medium size. Depressed. Yellow.

Hawley. Medium size.

Fall Harvey. Medium size.

Dutch Codlin. Above the medium size, pentangular. Calyx small, deep. Stem short and thick.

†Fall Pippin. Above the medium size. Stem long, deep. Calyx large, deep; depression plaited.

Holland Pippin. Much the same as Fall Pippin, but keeps longer.

Lyman's Pumpkin Sweet. Above the medium size.

Downton Pippin. Medium size. Calyx large; depression very shallow. Stem short, deep.

Class III. *Fruit russet or semi-russet.*

Order I. Height and breadth equal or subequal

B. Ends unequal.

Pumpkin Russet. Full medium size.

Pine-apple Russet. Above the medium size, angular. Calyx depression shallow, many-plaited.

Dowell's Pippin. Nearly of the medium size. Crown pointed. Stem short, deep.

Cheeseborough Russet. Above the medium size. Crown rather pointed. Stem short.

Early Nonpareil. Medium size. Stem long, slender. Calyx depression very shallow.

Order II. Breadth greater than the height.

A. Ends equal or subequal.

Radley's Pippin.

Scarlet Crofton. Medium size, subangular. Stem short, flaccid. Calyx depression wide and shallow.

Braddock Nonpareil. Medium size, depressed. Stem short, insertion shallow.

B. Ends unequal.

Ross's Nonpareil. Medium size, circular. Calyx depression shallow. Stem long; insertion deep, and protruding beyond the base.

†Bowyer's Russet. Below the medium size, circular. Calyx depression small. Stem half an inch long; depression regular.

Pitmaston Russet or Nonpareil. Medium size, flat. Calyx depression broad and shallow. Stem short; insertion shallow.

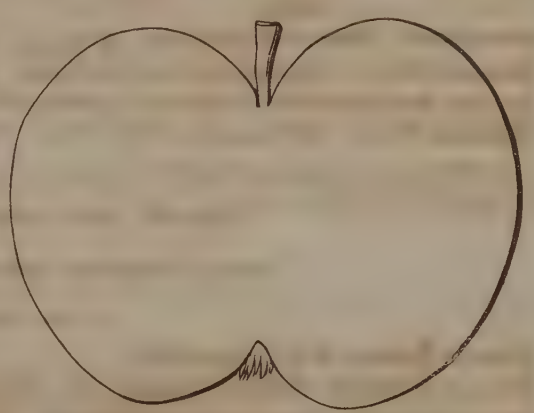
DESCRIPTION OF AUTUMN APPLES.

Class I. *Red, or red striped upon yellow or red ground, or with brownish stripes, ornaments, etc.*

Order I. Height and breadth equal or subequal.

A. Ends equal or subequal.

1. WESTFIELD SEEKNOFURTHER. Fig. 8.



Fruit of the medium size, excentric, rather elongated. Calyx implanted in a shallow depression, with a large funnel-form space towards the core. Stem rather short and thick; depression equaling the crown; base rounded. Color, ground yellow and striped with carmine, deeper on the sunny side, greenish russet within the stem depression, dotted upon the bright side. Taste and flavor not very unlike a Spitzenberg. Ripe in October, but keeps till January, and is usually regarded as a winter apple.

2. FALL STRAWBERRY. Plate 25.

Fruit of the medium size; ends subequal; breadth somewhat greater than the height, circular, slightly compressed. Stem rather long, and set in a deep and rather wide regular depression. Calyx medium size and depth, closed, and surrounded by a wide crown. Color, bright yellow ground, striped with red, and deeper upon the sunny side; crown bright yellow, and the red distributed about the base. Flesh white with a faint reddish tinge; juice rich, subacid. Core small. Calyx-tube closed. Ripe in October. Exhibited at the New-York Fruit Convention in 1848.

3. STRIPED HOLLAND PIPPIN.

Fruit of the medium size, subpentangular. Stem short; depression shallow. Calyx small. Color yellow, striped with carmine on the sunny side. Flesh white, subacid, rather dry. Ripe in October, and continues in December.

A Dutch culinary apple of moderate excellence.

4. WILLIAMS'S PIPPIN.

Fruit below the medium size, circular; ends subequal, rather conical. Calyx leafy. Stem short, deep. Color yellow, mottled with pale red on the sunny side. Flesh yellowish, tender; flavor pleasant and agreeable if eaten from the tree. Ripe in October; keeps till christmas.

5. HALL'S SEEKNOFURTHER.

Fig. 9.

Fruit rather below the medium size, conical; ends subequal. Stem fleshy, recurved; depression obsolete. Calyx depression shallow. Color yellow, with dark and rather dingy carmine stripes.

It is an old fruit; known in some parts of Massachusetts as the Seeknofurther. A very good apple, but not equal to many now under cultivation.

B. Ends unequal.

6. GRAND SACHEM.

Fruit above the medium size, rounded, ribbed; outline irregular. Stem short, thick. Calyx depression well marked. Color dark blood red or dingy red. Flesh white, rather dry, without much flavor. September. DOWNING.

7. JERSEY SWEETING.

Fruit of the medium size, roundish ovate, tapering to the crown. Calyx small; depression shallow, plaited. Stem half an inch long; depression narrow. Color yellow, striped with pale red. Flesh white, tender, juicy, sweet and pleasant, without bitterness. Ripens by the first of September. Valuable for cooking, and fattening stock.

8. KILHAM HILL (*Manning.*)

Fruit above the medium size, ribbed, tapering to the crown. Stem long, slender, set in a deep depression. Calyx depression narrow. Color pale yellow, splashed with red slightly in the shade, deep in the sun. Taste and flavor bright and agreeable, but becomes mealy by keeping.

Tree a good bearer, and ripens its fruit in September. A native of Essex, Massachusetts, and raised by DANIEL KILHAM.

9. KING OF PIPPINS (Lond. Hort Soc. Cat. No. 519).

Hampshire Yellow, Lond. Hort. Soc. Cat. No. 421, according to the Hort. Mag. and Hor.

Fruit above the medium size, broadest at the base. Calyx depression rather deep, only slightly plaited. Stem long, slender, projecting beyond the funnel-shaped depression. Color yellow, tinged red and streaked faintly on the sunny side. Flesh yellowish, firm, sweet, juicy and high flavored.

In use from November to December. Tree a good bearer.

10. RED INGESTRIE.

Red Ingestrie, Lond. Hort. Transactions, Vol. i, p. 227.

Fruit of the medium size, circular. Calyx small. Stem short, slender. Color bright yellow, deeply tinged with red on the sunny side, and marked with indistinct white spots. Flesh yellowish, firm, juicy and rich.

An English apple, and ripe in October; was one of Mr. KNIGHT'S seedlings, raised from the seeds of the Orange Pippin.

11. DUKE OF BEAUFORT'S PIPPIN (Lond. Hort. Cat).

Fruit above the medium size, pentangular; five strong ribs alternating with five obscure ones. Calyx deep. Stem protrudes beyond the base, deep. Color green, striped on the sunny side with clear, pale red, between the ribs only. Flesh pale greenish white, crisp and tender, juicy, subacid, pleasant. Fruit adapted to the kitchen, and keeps till christmas.

12. SUMMER PEARMAIN (*Lindley*). PLATE 27, Fig. 1.

Autumn Pearmain, THOMPSON. *Royal Pearmain*, English gardens. *Pearmain d'Ete*, KNOOP.

Fruit medium size, circular. Stem short. Calyx set in a wide shallow depression, which is plaited. Color brownish yellow, striped with deep red on the sunny side, and dotted. Flesh yellowish, crisp, firm and rather dry, but its flavor is high and agreeable; taste subacid.

13. RACE'S RED. Plate 48, fig. 1.

Fruit of the medium size, sub-circular, rather elongated. Stem short and rather thick, and set in a deep russetty depression; base rather wide, and tapers from near the middle of the apple each way. Calyx small, plaited in a shallow depression. Color carmine, paler on the shaded side, and the coronal end with a few grayish dots. Flesh yellowish, tender, rather acid, crisp. Core and calyx small.

Exhibited at the Pomological Convention, New-York, by E. G. Studley, of Claverack, Columbia county. The apple is very fine, and worthy of cultivation.

14. MARK'S NEW STRAWBERRY APPLE. Plate 52, fig. 1.

Fruit of the medium size, elongated, tapering to the crown. Stem rather long, slender, deeply inserted. Calyx large; segments leafy, closed and prominent, shallow. Crown narrow. Color carmine, striped and darker upon the sunny side, dotted sparsely; spots arranged in stripes. Flesh white, tinged reddish near the skin: a red streak encircles the core. Flesh tender, juicy; flavor quite like the strawberry. Ripe early in October, but suitable for cooking early in September.

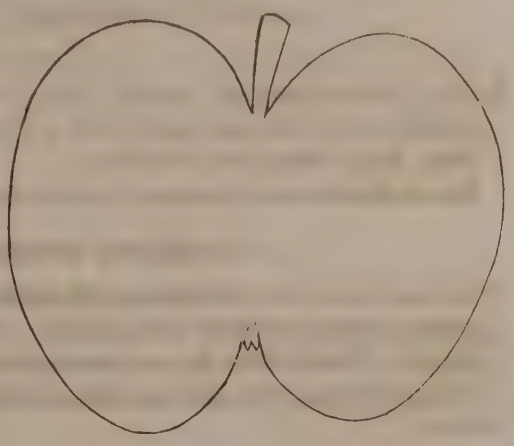
This apple was exhibited at the Fruit Convention in New-York, by A. Mark, esquire, of Durham, Greene county. It must be regarded as ranking high among the autumn apples. I have been unable to identify it under any described fruits, and hence have noticed it as above.

15. AUTUMN STRAWBERRY. Plate 75, fig. 1.

A dark carmine apple, deeper in spots, scarcely striped; ends subequal, medium size. Stem projects beyond the base; depression moderately deep, and spread with thin russet. Calyx rather large, moderately deep. Flesh white, juicy, stained with red around the calyx. Flavor resembles the strawberry, and is a fine October fruit.

16. LATE STRAWBERRY.

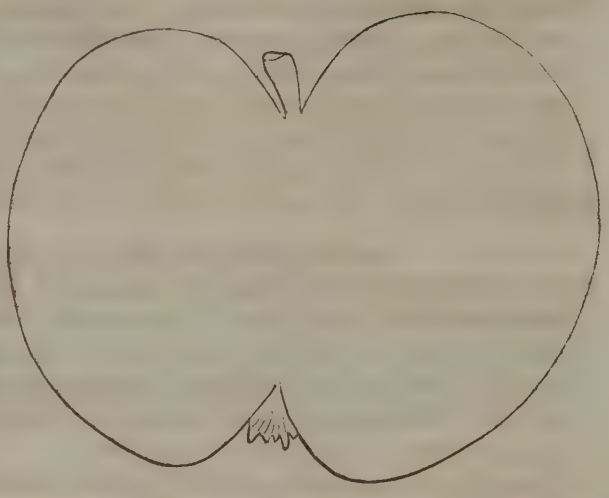
Fig. 10.



Fruit near the medium size, symmetrical, circular, slightly elongated. Stem projects beyond the base; depression russetty, extending outward in a stellated form. Calyx rather small, nearly closed. Color carmine, and with slashes of deeper on the sunny side, dotted. Flesh subacid, stained reddish around the core; flavor of the strawberry, juicy.

Probably the Autumn and Late Strawberry are the same, while the Fall and Mark's New Strawberry are different varieties. The Late Strawberry has a deeper stem depression than the Autumn, but their characters are so near alike that they may be regarded as the same.

17. MARK'S UNKNOWN. Fig 11.



Fruit of the medium size, fair, smooth, glossy, circular, subsymmetrical, widest in the middle; base wide; depression wide and rather deep, inclosing a short thick stem. Crown pointed, inclosing a large calyx in a rather narrow ridged depression. Color carmine upon yellow ground, and irregular spots of a deeper color arranged somewhat in stripes; crown yellow. Flesh white, juicy, tender (when over ripe, mealy), strawberry flavor distinct.

Exhibited in New-York at the Fruit Convention, 1848. Probably an old variety which has been lost sight of, but worthy of cultivation. Ripens in September, and continues till November. It may be regarded as belonging to the Strawberry family, and hence I have placed it in connexion with those just described.

An apple has been circulated under the name of Washington County Strawberry, and is considered a seedling. It was first sent to the rooms of the State Agricultural Society by Mr. David Whipple, of Union village, by whom I believe it was raised from the seed. It, however, resembles in taste and flavor the Gravenstein. It appears to be a good apple, but is not yet sufficiently known to be recommended for cultivation.

18. SCARLET PEARMAIN (Lond. Hort. Soc. Cat. No. 767).

Bell's Scarlet.

Fruit of the medium size, conical. Stem long, slender, deep. Calyx deep; depression plaited. Color red intermixed with yellow, crimson on the sunny side. Flesh white, crisp, juicy, sugary and pleasant.

Ripe in September in England, and continues till December.

19. VIRGINIA SWEETING. Plate 74, fig 1.

Fruit much above the medium size, elongated, ribbed. Stem short. Calyx rather large, closed; depression rather deep, plaited. Color carmine in stripes upon a yellow ground, dotted. Flesh yellow, juicy, sweet, and, when not over ripe, lively and agreeable.

It is a fine apple for cooking, but too little flavor to be popular for eating. Ripe in October.

A. Ends equal or subequal.

20. RAMBO.

Romanite, Seeknofurther, Bread-and-cheese, of New-Jersey.

Fruit of the medium size, circular, depressed or flattened. Skin smooth and fair. Stem rather long and slender, and set in a deep and wide depression. Calyx medium size, and inclosed in a shallow depression. Crown low and wide. Color yellow; sunny side blazed with carmine, which is interspersed with grayish green dots. Flesh yellowish, rich and juicy.

It is regarded, in Pennsylvania and New-Jersey, as one of the best of their apples: it is also ranked in this State as one of the first and best of apples.

21. BLENHEIM PIPPIN (*Thompson, Lindley*).

Blenheim Orange, Woodstock Pippin.

Fruit above the medium size, roundish. Calyx depressed in a large basin. Color orange yellow, and striped on the sunny side with dingy carmine. Flesh yellowish, very sweet. A large cooking apple especially for baking, and in use from October to December.

22. BEAUTY OF THE WEST.

This is another large, showy, sweet cooking apple, but superior to the above. Color light greenish yellow, ornamented with thin stripes of carmine on the sunny side. Stem short; depression round. Flesh tender, juicy, sweet and pleasant.

Although an autumn apple, it has good keeping qualities.

23. KERRY PIPPIN (*Thompson, Lindley*).

Hampshire Yellow.

Fruit medium size, round-oval; crown somewhat flattened, unsymmetrical. Stem half an inch long, set in a narrow depression. Color pale yellow, fair, shining, stained and striped with carmine. Calyx of the medium size, and inclosed in a plaited depression. An Irish apple, and ripe in October.

24. NONSUCH (Lond. Hort Soc. Cat. No. 677).

Langton Nonsuch, Hanbury, Hoy, Forsyth.

Fruit of the medium size, round and regular. Stem short, slender. Calyx closed and confined in a shallow and rather wide excavation. Color yellow, marbled with orange; brick red stripes, broken or in patches, on the sunny side. Flesh white and tender, and is regarded as a fine apple for jellies.

It is difficult to class and determine the varieties in this country which are locally known under the name of *Nonsuch's*. Most of them are winter apples : in other respects, there is much similarity among them.

25. RAMBOUR FRANC (*Duhamel*).

Franc Rambour, Switzer. *Rambour Gros*, Lond. Hort. Soc. Trans.

Fruit above the medium size; form irregular. Stem short; depression deep, russetty. Calyx open and rather large; depression deep, plaited and angular. Color pale yellow, stained with carmine on the sunny side. Flesh tender, subacid.

An apple ripe in October and November, but not remarkable for good qualities : principally used for culinary purposes.

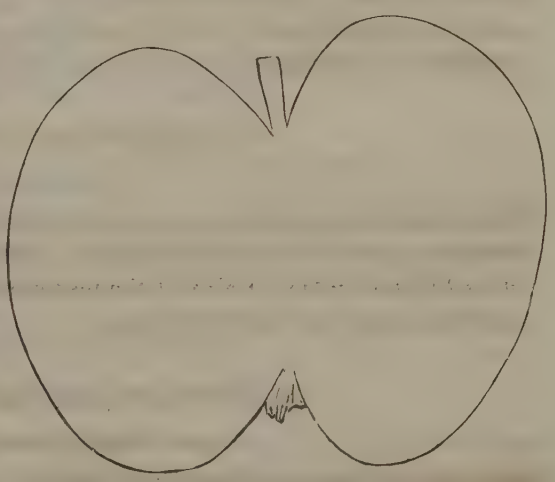
26. CORNISH AROMATIC (Lond. Hort. Trans. Vol. ii, p. 74.)

Fruit of the medium size, roundish; crown angular. Stem short; depression narrow, deep. Calyx small; depression rather deep. Color soft russet brown on the shaded side; deep bright red on the sunny side, intermixed with russet, and sprinkled with lemon-colored dots. Flesh yellowish, juicy, firm : rich aromatic flavor.

A desert apple from November to February.

27. SUMMER WINE.

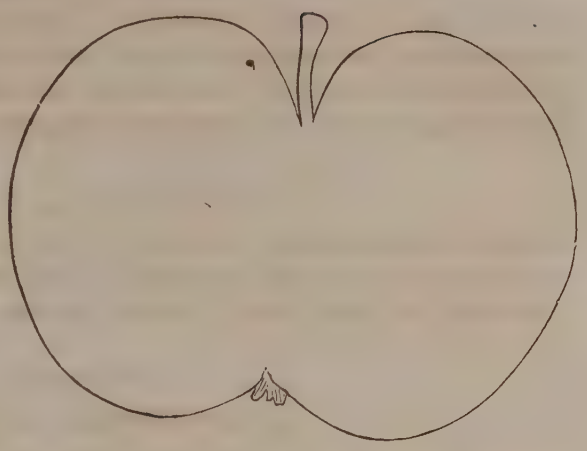
Fig. 12.



Fruit of the medium size, rather unsymmetrical, circular, depressed; ends subequal. Stem rather long and slender; depression rather large and wide, smooth. Calyx rather large, nearly closed; depression shallow, smooth. Calyx-tube rather open, and extending nearly to the core. Color red, deep upon the base and paler upon the crown, greenish around the stem, striped. Flesh white, juicy, subacid and rich.

This is a New-Jersey apple, and excellent in October.

28. HURLBURT APPLE. Fig. 18.



Fruit of the medium size, depressed; ends subequal, circular, widest in the middle. Stem extends beyond the base; depression rather deep, russetty. Calyx small, placed in a shallow ridged depression. Color yellow, with carmine stripes; striped faintly over the crown. Flesh white, tender, juicy, subacid, pleasant.

Ripe in October: belongs to the Strawberry family in flavor and taste; yet, not as rich as Mark's New Strawberry. Exhibited at the New-York Fruit Cultivators' Convention, New-York, 1848.

29. BREBECOURT PIPPIN (Lond. Hort. Trans. Vol. v, p. 400).

Fruit above the medium size, slightly depressed, circular. Stem slender and deep. Color, ground pale yellow, beautifully ornamented with interrupted stripes of carmine. Flesh crisp, and with a high flavor.

An English apple, originating in Berkshire, and described in 1822. It is ripe in October, but does not keep long.

30. COLVILLE ROUGE DE MICOUD (Lond. Hort. Soc. Trans. Vol. v, p. 242).

Fruit of the medium size, angular or sub-quadrangular, depressed. Stem rather long, rather thick; depression funnel-shaped. Calyx depression larger than that of the stem. Color very deep dull red on the sunny side, slightly striped with red on the shaded side. Skin rough, subastringent or austere, and adheres to the flesh. Flesh yellowish, juicy; juice sweetish, acid, and pleasantly perfumed.

The crop of Colvilles first comes to maturity in August, and continues till November. The peculiarity of the variety consists in a successive production of flowers and fruit through the season. The original tree, according to M. Andre Thouin, bears 3000 apples annually. The first flowering takes place in April; the second, in June. It is of French origin.

31. CHRISTIE'S PIPPIN.

Fruit of the medium size, depressed, circular. Calyx small and closed. Stem short, slender, deep below the base. Color greenish yellow, bright on ripening; sunny side striped with red. Flesh yellowish, tender, saccharine and pleasant. October and November. Esteemed for the kitchen.

32. COBHAM APPLE.

Fruit above the medium size, subangular. Stem slender, deep. Color yellowish green, ornamented on the sunny side with faint red stripes, and somewhat russetty. Flesh yellowish, crisp, saccharine and aromatic. Keeps till christmas.

It is an English apple, and esteemed for the desert.

33. CATLINE (*Coxe, Thompson*).

Fruit below the medium size, depressed. Stem short and thick. Color yellow; sunny side of a clear brilliant red, and striped. Flesh yellowish, tender, rich, juicy and sweet.

It is a Maryland apple, and is in eating from October to December.

B. Ends unequal.

34. GRAVENSTEIN. PLATE 28, fig. 1.

Fruit above the medium size, depressed, subangular, subsymmetrical. Stem thick, short, and set in a deep depression. Calyx large, and surrounded by a rather high crown; depression rather large, irregular. Color greenish yellow, from which it changes into a brighter yellow; when ripe, it is blazed with stripes of light red and orange. Depression yellow. Skin smooth, and without dots. Flesh tender, crisp, somewhat aromatic and high flavored; if over ripe, mealy. The core is small.

This is regarded by good judges as one of the best of our foreign apples. It originated in Germany, at Gravenstein; and Mr. DOWNING remarks that it is one of the kinds which maintains its reputation for goodness. It is in use in September and October.

35. LYSCOM (*Manning, Kenrick*).

Fruit rather above the medium size, circular, depressed. Stem short and thick; depression rather deep and wide, smooth and even. Calyx small; depression shallow, plaited. Color yellowish green, ornamented with red stripes. Flesh firm-grained, subacid, mild and very agreeable. It is ripe in September to November.

Originated in Massachusetts.

36. ALEXANDER (*Thompson*).

Emperor Alexander, Russian Emperor, APORTA.

Fruit considerably above the medium size, circular; ends equal. Stem rather slender, deep, subequaling the crown. Calyx large, leafy, deep. Color greenish yellow, and faintly striped on the shaded side; brighter, and well ornamented with carmine stripes upon an orange ground, upon the sunny side. Flesh yellowish, and eating qualities rather below the best: it is more showy than good.

Of Russian origin, and bears with many a high reputation.

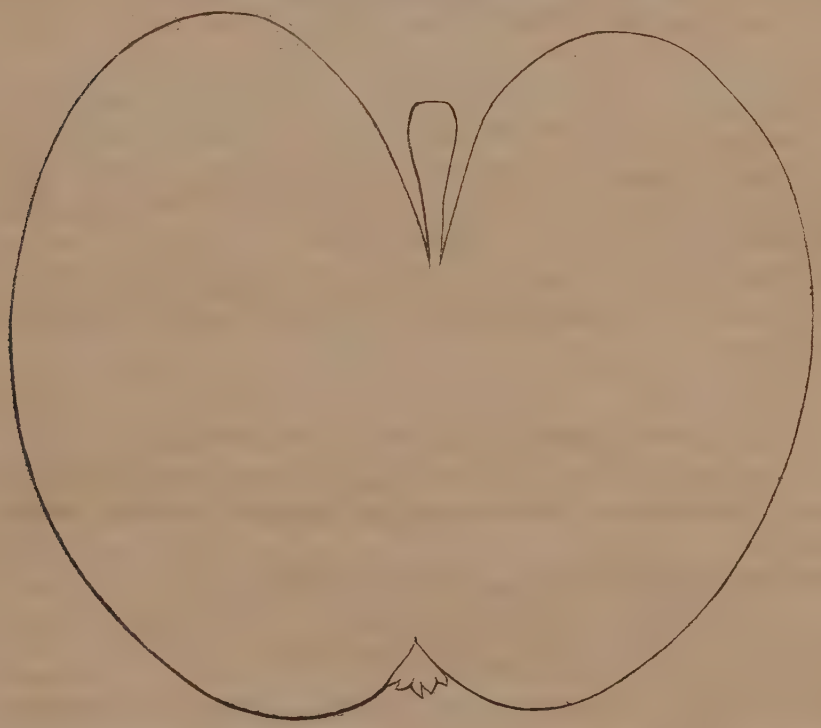
37. SOPS OF WINE (*Lindley, Ray.*)

Rode Wyn Apfel, Knoop. *Sapson,* Kenrick.

Below the medium size, globular, fair. Crown narrow, or ends unequal. Stem slender, long. Calyx open; depression shallow. Color carmine; deeper in spots on the sunny side. Flesh white stained purplish, firm, crisp, juicy, subacid, pleasant.

An excellent apple. September.

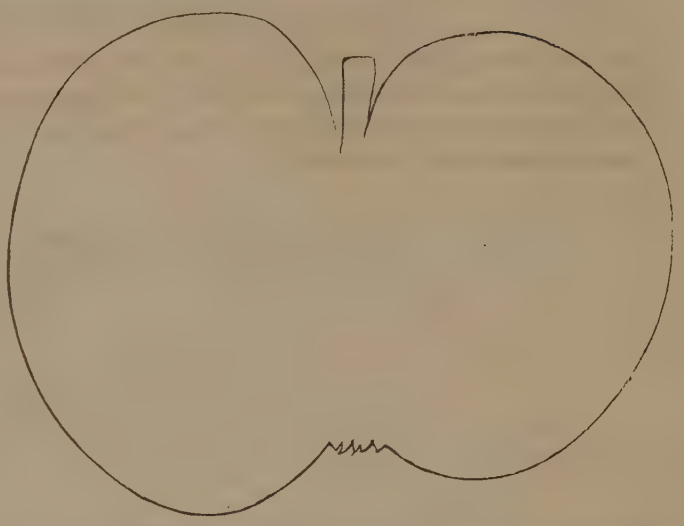
38. TWENTY OUNCE PIPPIN. Fig. 14.



Fruit considerably above the medium size, circular, tapers to the crown. Stem short, thick; depression very large, deep. Calyx small; depression shallow, scarcely ridged. Color pale carmine softened with yellow; shaded side yellow. Skin dotted, pappillated. Subacid; texture coarse, rather dry.

A second-rate apple, large, useful for culinary purposes: too large for profit.

39. WHITE VANDERVERE Plate 24, fig. 1. Fig. 15.



Fruit of the medium size, depressed and eccentric. Color pale golden yellow and ornamented with faint stripes of crimson, spreading over a large part of the apple. Calyx rather large and the tube nearly open to the core. Stem rather thick and short, unprojecting, fleshy in the middle, and inserted in an eccenctric depression. Flesh yellowish white, subacid, pleasant, inclining to sweet.

This apple becomes rather mealy, or is past eating early in November; yet it is a fine apple for the desert, and is worth cultivating. It is characterized by its eccentric form or lateral compression.

40. DUCHESS OF OLDENBURGH (*Thompson*).

Fruit of the medium size; form symmetrical, fair and smooth. Calyx rather large, deep; depression without plaits. Color yellow, finely worked and striped with red. Flesh rich, juicy.

Excellent apple of Russian origin; ripens in September.

41. BEAUTY OF KENT (*Forsyth*).

Fruit of the medium size or greater, irregular in form or unsymmetrical, subangular; crown contracted. Calyx rather small, closed. Stem short, slender, deep in a funnel-shaped depression. Color yellowish green, mottled with dull or dingy red; bright red on the sunny side. Flesh firm, yellowish, crisp, juicy, pleasant. Keeps until christmas.

According to English authorities, is a very fine apple and withal beautiful.

42. HOARY MORNING APPLE (Lond. Hort. Soc. Cat. No. 455).

Dainty Apple.

Fruit a little above the medium size, subangular, depressed. Stem rather short; depression wide. Calyx small; depression small, angular and plaited. Color red arranged in interrupted irregular stripes; paler on the shaded side, with a bloom. Flesh yellowish, firm, sometimes tinged red next the skin; flavor rich and brisk.

A cooking apple till christmas.

43. LONGVILLE KERNEL.

Sam Crab.

Fruit of the medium size, subangular, conical. Stem short, deep; depression deep. Calyx small; depression plaited. Color greenish yellow, striped and spotted with deep red, Flesh yellowish, firm, juicy, perfumed, subacid, rich.

An English dessert apple of considerable note and merit: is from early August to September.

44. GALWAY RED. Plate 35, fig. 1.

Fruit of a full medium size, symmetrical. Color deep red, and evenly striped upon a yellow ground; skin dotted yellowish, though the dots are sparse. Stem thick and set within a narrow depression, from which it does not project. Flesh stained reddish yellow, though the red is faint. Calyx large. Flesh rather coarse; taste subacid, pleasant. Is only second rate.

This apple was sent from Galway, Saratoga county, by Mr. Daniels. It is very beautiful.

45. FLOWER OF KENT (Hort. Soc. Cat. of London).

Fruit of the medium size, depressed, irregularly ribbed: color yellowish green on the shaded side, and brownish with stripes of red on the sunny side. Stem rather short, but extending beyond the base. Calyx small, contracted, and enclosed in a ribbed basin. Flesh greenish yellow; juice pleasant, and in sufficient quantity to make it a good cooking apple. Keeps till Christmas in England.

46. KENRICK'S AUTUMN.

Fruit above the medium size. Base flattened; circular. Color yellowish green, ornamented with bright red stripes. Stem long, and projecting beyond the base. Flesh slightly stained red; sub-acid and lively.

It ranks only as second or third rate.

47. PEACH POND SWEET.

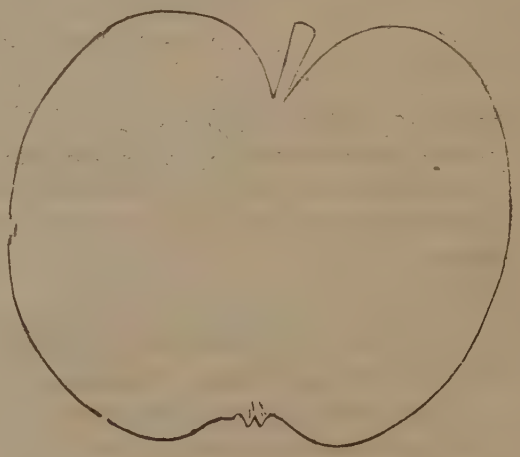
Fruit of the medium size; subconical. Color pale greenish yellow, and ornamented with delicate or thin stripes of red. Stem slender, variable in length. Flesh tender, sweet, and rich.

In use in mid autumn, and regarded as a valuable apple. It originated in Dutchess county, N. Y.

48. FAMEUSE (Pomme de Neige). Plate 48, fig. 2. Fig. 16.

Fruit rather below the medium size, or equaling it, circular. Color whitish, and ornamented with stripes and blotches of fine deep red. Stem projecting slightly beyond the base, slender; depression narrow. Calyx depression shallow, small and wrinkled. Flesh white, sub-acid, and juicy, and somewhat spicy. Pleasant. Shoots diverging, and rather thin or flexuous.

It is an excellent apple.



Class II. *Color yellow, or yellow with an orange red blush, or green, greenish yellow with a brown blush.*

Order I. Height and breadth equal or sub-equal.

A. Ends equal or sub-equal.

49. KIRKE'S GOLDEN PIPPIN (Hort. Soc. Cat. of London.)

Fruit below the medium size, circular, slightly elongated. Color pale green on the shaded side, and of a clear yellow on the sunny side. Skin fair and free from specks. Flesh pale greenish yellow; firm and crisp, juicy and pleasant.

It is considered a valuable apple in England; hardly known in this State.

50. MANKS' CODLIN.

Fruit of the medium size; oblong oval. Color pale yellow, with an orange blush. Stem fleshy. Calyx depression shallow and plaited. Flesh firm brisk sub-acid.

Valuable for cooking. English.

51. FRANKLIN'S PIPPIN (Franklin's Golden Pippin.)

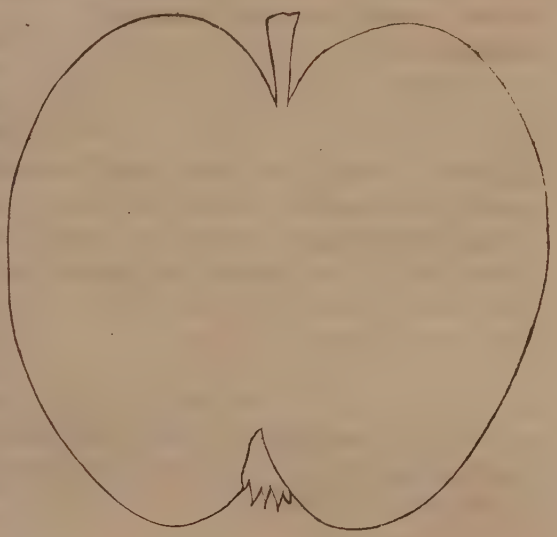
Fruit of the medium size, elongated. Color yellow. Skin marked with numerous dark specks. Stem short, slender. Flesh tender, crisp and rich, with an aromatic juice. Tree grows vigorously, and ripens its fruit in mid autumn.

52. KESWICK CODLIN.

Fruit of the medium size, elongated. Ribs obscure. Color greenish yellow, and becoming pale. Stem short, and set in deep depression. Calyx rather large. Flesh juicy pleasant acid.

The tree is said to be a good bearer, and productive. English.

53. PORTER. Plate 27. Fig. 17.



Fruit of the medium size; fair, elongated and circular. Color yellow, and only slightly splashed with red on the base. Skin dotted sparsely. Stem equaling the base, or extending slightly beyond it. Calyx large; depression plaited. Flesh white, juicy. Core rather large. This apple is elongated, and is peculiar for its yellow color and the small extent of red stripes. The stem is set in a narrow depression, and surrounded with russet. Its flesh is tender and juicy, sub-acid, with a fine flavor.

Tree productive, ripens early in autumn, and is a valuable fruit for all the northern states.

54. YELLOW INGESTRIE (Hort. Trans. of London, vol. i. p. 227).

Fruit below the medium size, elongated. Color bright gold yellow. Skin fair, and slightly specked. Stem small, deeply set, and slightly protruding beyond the base. Calyx small. Flesh yellowish white, juicy, tender, and delicate.

An excellent English dessert fruit.

55. SEEKNOFURTHER (*Coxe*). Fig. 18.

Autumn Seeknofurther. KEN.

Fruit of the medium size, elongated, with a narrow crown. Color yellow or yellowish green, whitish. Flesh yellowish, juicy, rich and tender. Ripens in October.

It will be observed that this is a very different apple from the Westfield Seeknofurther, which is a striped fruit, and keeps longer. Downing remarks that the Seeknofurther of Pennsylvania and New-Jersey, is the Rambo. The name is also applied to many other kinds of less note. Almost every locality has its Seeknofurther.

56. STROAT.

Fruit of the medium size, circular and symmetrical. Color pale yellowish green. Skin marked with fine dots. Stem rather long, projecting and set in a rather shallow cavity. Calyx small; depression small and slightly ribbed. Flesh tender, sub-acid, pleasant. Flavor fine. Late autumn; and found to vary in quality with its location.

The name is Dutch, signifying street.

57. ALFRISTON (Hort. Soc. of Lond.)

Fruit above the medium size; elongated, ribbed. Color greenish yellow; skin slightly russet. Stem short. Flesh tender, acid, and third rate. Keeps till winter, but ripens in England in October.

58. CRAY PIPPIN (London Hort. Trans. vol. v. p. 401.)

Fruit below the medium size; angular elongated. Stem short. Calyx close, small. Depression even and regular. Color yellow, enlivened with an orange blush. Flesh yellowish white, crisp, well flavored.

An English apple, in use in October and November.

59. GRAY LEADINGTON (Hort. Soc. Cat. of London.)

Fruit above the medium size, elongated and conical. Pentangular, angles extending the length of the fruit. Calyx large; depression deep; stalk short, not reaching the base, but thick. Color yellow, with a deep red blush on the sunny side. Flesh tender, subacid, juicy.

A good culinary apple. English.

60. JUBILEE PIPPIN (Hort. Soc. Trans. of London, vol. v. p. 400.)

Fruit above the medium size, elongated. Ribs irregular, but extending from the base to the crown. Color pale straw yellow. Skin translucent, marked with dots. Flesh white, crisp. Cone large and open.

English; and regarded as a valuable dessert and culinary apple.

61. WARREN PIPPIN. Plate 54.

Fruit of the medium size, elongated, unsymmetrical. Ends subequal. Color green yellowish green. Sunny side brown, or reddish brown, extending from the base to the crown. Crown patched with yellow. Skin dotted. Fair and smooth. Stem slender, projecting beyond the base, and set in a deep but rather narrow depression. Calyx large; depression shallow, ridged or plaited. Plaits narrow. Calyx tube open. Flesh yellowish, juicy, tender, subacid, pleasant. Core rather open and large.

Excellent, in eating early in November.

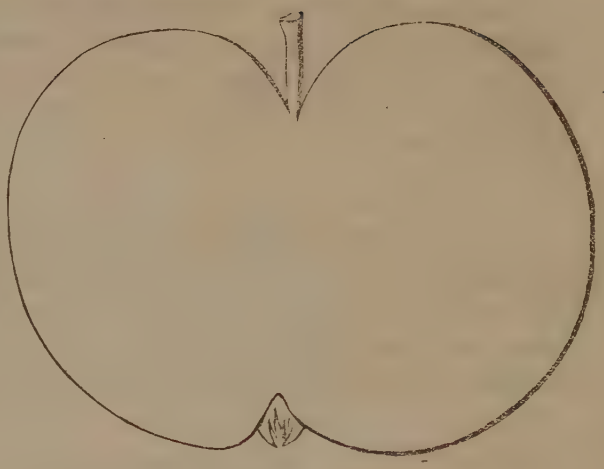
Order II. Breadth greater than the height.

62. DYER.

Pomme Royal.

Fruit larger than the medium size, elongated. Obscurely ribbed. Color yellow; cheek rarely faint brown, and slightly netted with russet. Stem three-fourths of an inch long. Calyx depression deep, and large ribbed. Flesh fine grained, tender and juicy. Flavor fine, excellent. Ripens late in the fall or early winter.

63. GOLDEN SWEET. Fig. 19.

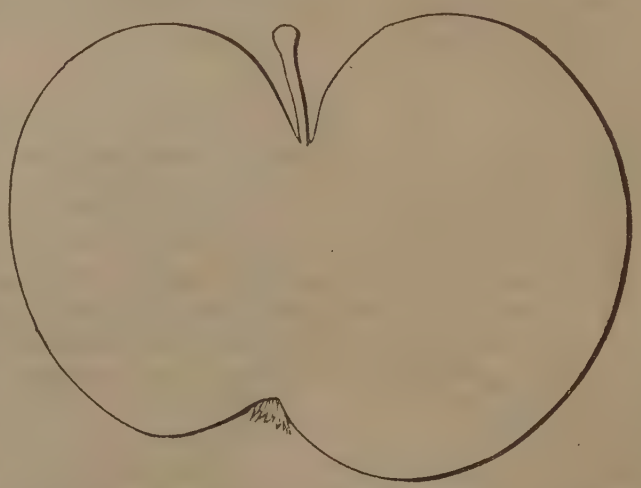


Fruit of the medium size, rather depressed or flattened. Color greenish yellow and yellow, fair. Stem slender, protruding beyond the base. Calyx medium size; depression shallow. Flesh tender, sweet. In New-England it is one of the best of apples for baking; and ripens in early autumn, and perhaps late in summer. Usually in use through September, but frequently on the table in August. *Very* valuable for its productiveness.

64. HAWTHORNDEN (White Hawthornden.)

Fruit full medium size, elongated somewhat. Color yellowish white, enlivened with a blush on the sunny side. Stem thick and stout. Calyx set in a regular formed and plaited depression. Flesh juicy, white, and pleasant, but not rich. English.

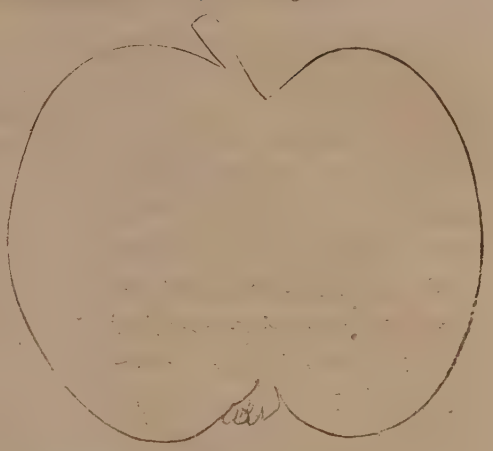
65. MAIDEN'S BLUSH. Plate 30. Fig. 20.



Fruit full medium size, circular, depressed. Color yellowish white or green, enlivened with a deep crimson blush upon the sunny side. Fair. Stem rather short, scarcely extending beyond the base. Depression wide and rather deep. Calyx medium size; depression rather shallow. Flesh white, tender, juicy, and pleasant. Subacid. Esteemed by some as rich. Uniformly productive, but occasionally defective.

It bears a good price in market (New-York), and is well worth cultivating. Tree full medium size, spreading. Ripens its fruit in October. If well put up, may be kept till spring; but its keeping properties are uncertain. It is a fine apple in the valley of the Hudson.

66. SUMMER SWEET PARADISE. Fig. 21.



Fruit medium size, rather depressed or flattened at the ends. Circular. Color pale green. Stem thick and short. Calyx depression wide. Flesh tender, sweet, rich. Flavor aromatic. Ripens early in October.

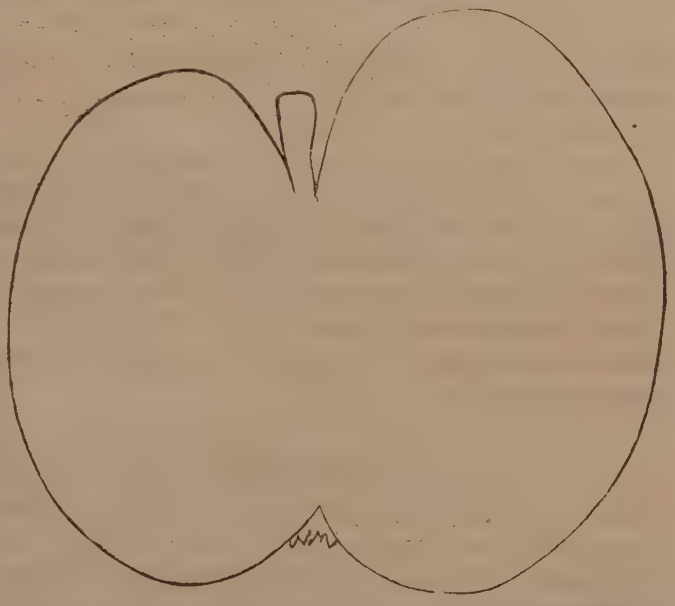
It is regarded as a fine apple. Originated in Pennsylvania.

67. WORMSLEY'S PIPPIN.

Fruit of the medium size. Color pale greenish yellow. Stem rather long. Calyx sunk deep in its depression. Flesh white, firm, crisp; high-flavored, acid. English.

68. GLORIA MUNDI. Plate 35. fig. 34. Fig. 22.

Ox Apple, Baltimore Apple, Kinderhook Pippin, var. Monstrous Pippin.

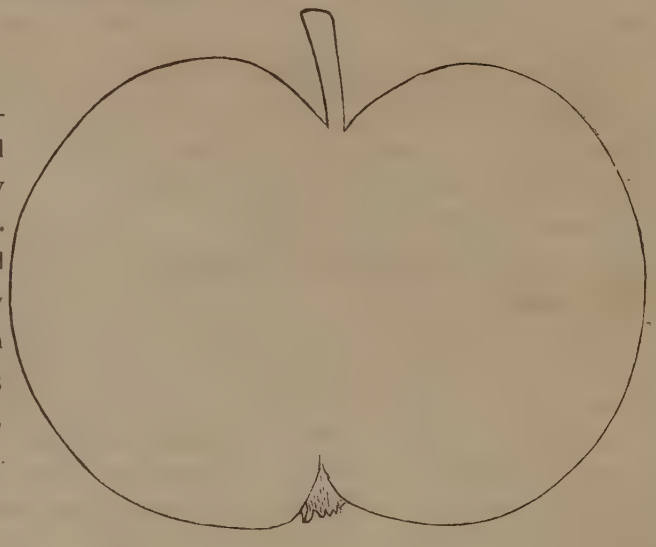


Fruit above the medium size; often unsymmetrical Ribs wide, skin fair and smooth. Color yellow, becoming whitish yellow. Stem thick, short. Flesh white, tender, but rather coarse. Subacid. Late autumn; and keeps, if carefully gathered, till January.

This apple, though ranked only as second rate, yet sells well in market, often as high as three pennies apiece. It is a good apple for culinary purposes, but not rich enough for the dessert.

Plate represents a variety or subvariety from Kinderhook, which is rather smaller than those produced at some other places, but which has a better flavor.

69. NORTHERN GOLDEN SWEET. Plate 50. Fig. 23.



Fruit full medium size; depressed, excentric angular or ridged faintly. Color yellow, sunny side enlivened with orange. Stem long, projecting beyond the base. Depression partially closed. Calyx large; skin smooth and fair; core small; calyx tube open. Flesh white, juicy, and tender, and sweet.

70. SLINGERLAND'S FALL PIPPIN. Plate 32.

Seedling of the Newtown Pippin, new.

Fruit the medium size, depressed; stem projecting. Color yellow, finely splashed with reddish orange upon the base. Calyx of a medium size. Core small. Flesh firm, yellowish, subacid, high flavored.

This apple was raised from the seed by Mr. Slingerland of Albany county. In procuring this variety, the seed of two barrels of apples of the Newtown pippin were sown, and only two varieties were obtained, which were worth cultivating. This is closely allied to the Newtown pippin; but instead of being a winter apple, or a long keeper like its parent, it is only a late fall fruit, or an early winter. When carefully gathered, it keeps very well. Its eating qualities, however, are quite equal to the Newtown pippin; and it is highly deserving of cultivation in the valley of the Hudson. Experience will determine its qualities for general use.

71. OAKE'S APPLE. (Hort. Soc. Cat. of London.)

Fruit of the medium size, irregular in form; angular. Color pale green, ornamented with interrupted streaks of brown. Skin thickly dotted, and slightly russet on the sunny side. Stem short, thick, never exsert, depression narrow. Flesh soft greenish white; juice saccharine; flavor wanting.

An English, and ripe in November.

72. PHILADELPHIA PIPPIN. (Lond. Cat.)

Fruit rather above the medium size, flattened at the crown. Calyx small; stem short; depression deep. Color yellowish gray, enlivened with a faint blush on the sunny side. Flesh white; flavor brisk and lively. Fruit single; perfect.

This is of American origin, but was first made known about seventy-five years ago, in England. It is only designed for the kitchen.

73. WYKEN PIPPIN. (Loudon's Gard. Magazine.)

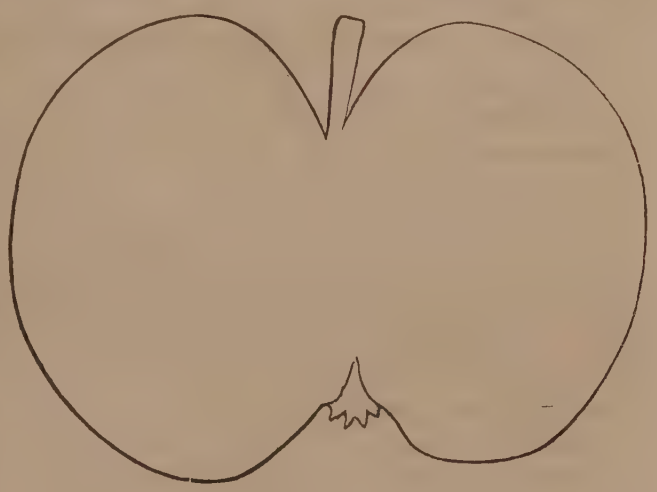
Fruit below the medium size, flattened at the ends, or depressed. Color green, and only slightly tinged brownish on the sunny side. Skin dotted with gray specks. Flesh yellowish green, crisp, and firm. Sugary. Flavor a musky perfume.

Regarded as neat dessert apple, from October to December, in England, especially in the county of Warwick.

74. COOPER'S REDLING. Plate 77. Fig. 24.

Fruit full medium size; form symmetrical, circular, and wide. Color yellow and fair, ornamented with a dark crimson, which spreads over one-half the apple. Skin smooth, sparsely dotted; ends subequal; both depressions wide. Stem equalling the base, and scarcely exsert. Calyx tube nearly closed; core small. Flesh white, firm, juicy.

Excellent, allied to the Maiden's blush, but later in ripening. N. Y. Exhibition, 1848.



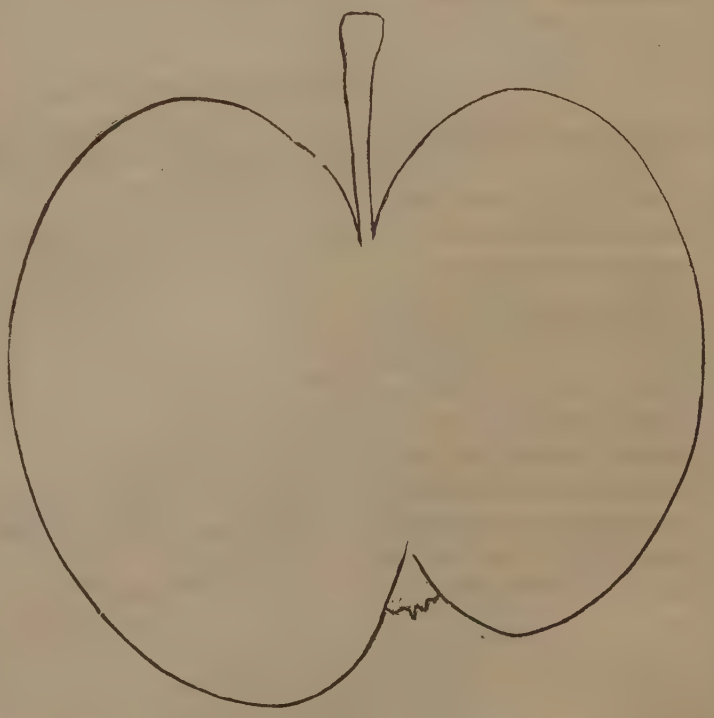
75. FALLAWATER. Plate 46, fig. 1.

Fruit about the medium size, symmetrical, circular, breadth and length equal. Color green, enlivened with a clear well defined scarlet cheek. Stem thick; depression narrow and close. Calyx small, closed; depression nearly obsolete. Flesh subacid, firm, fine flavored; a good keeper. Ripens late in the fall or early winter.
Origin in Pennsylvania.

76. POTTER'S LARGE APPLE (Hort. Soc. Cat. of London).

Fruit above the medium size, irregular and angular. Color pale green, tinged reddish near the base. Stem long. Flesh white and deficient in juice; subacid. Culinary apple, keeping till christmas. English.

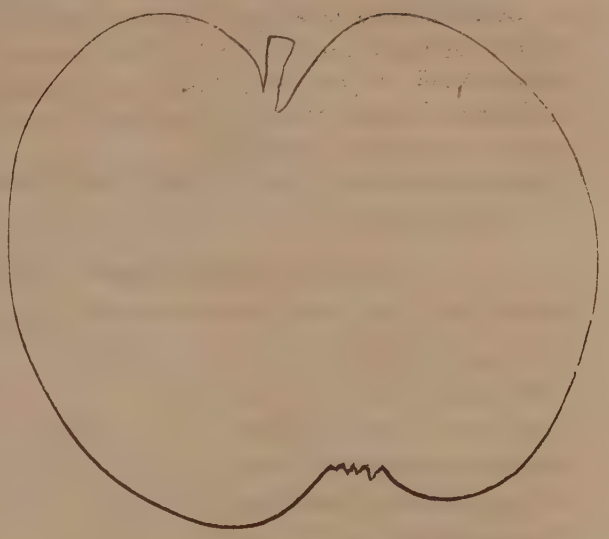
77. FALL PIPPIN. Fig. 25.



Fruit above the medium size, symmetrical, circular. Color yellow or greenish yellow, sometimes enlivened with a scarlet blush about the base. Stem rather stout, exsert or projecting beyond the base; depression rather large and deep. Calyx large and deep; crown prominent. Flesh yellowish white, juicy, fine flavor. Core small. Sometimes keeps till January, but is strictly an autumn apple. It is one of the finest fruits for cooking, and is equally desirable for the table.

Succeeds well in all parts of New-York; some of the finest specimens have grown in the eastern part of Rensselaer county.

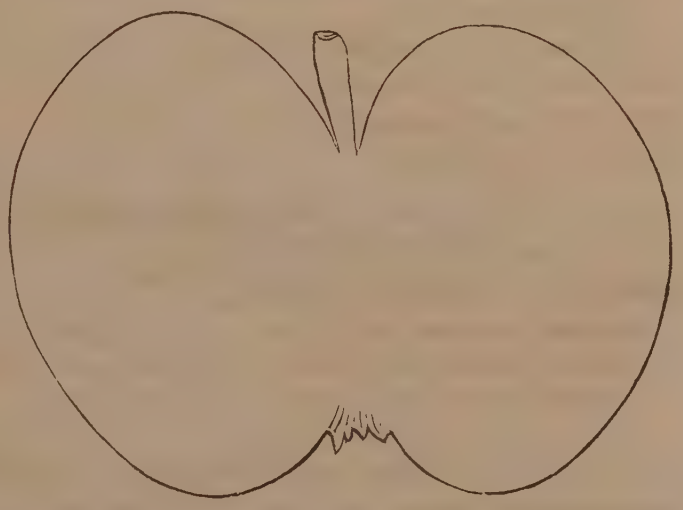
78. SPANISH PIPPIN. Plate 51, fig. 1. Fig. 26.



Fruit of the medium size, circular. Color yellow, ornamented with orange on the base and which extends to the middle; skin faintly dotted. Stem very short and slender. Calyx large. Flesh Yellowish white, subacid, juicy, but inclining to sweet.

This is a New-Jersey apple which ripens in October, and is esteemed for its qualities.

79. MONMOUTH PIPPIN. Plate 57. Fig. 27.



Fruit of the full medium size, depressed, circular, wide. Color yellowish green, ornamented with carmine about the base, and extending in interrupted patches toward the crown; skin roughish, dotted with small green specks. Stem stout, scarcely exsert; depression large and wide. Calyx large; depresssion wide and ridged. Flesh firm, rather juicy, greenish yellow.

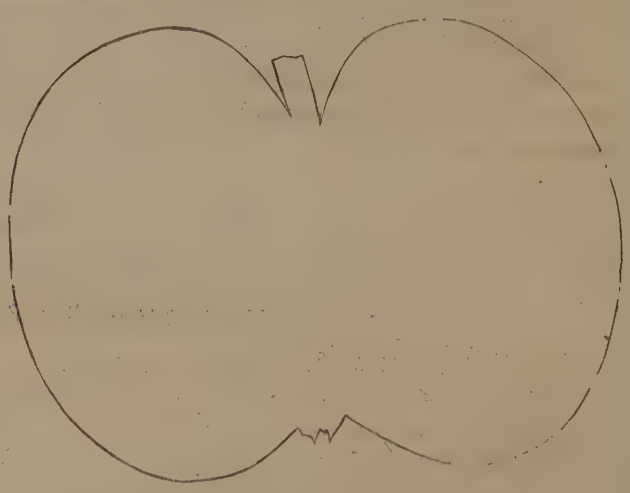
A second rate New-Jersey apple, liable to a defect in the core. The base of the apple is wide; it tapers from the middle to the crown.

80. RIDGED PIPPIN Plate 55.

Fruit of the medium size, wide at the base, ridged, circular. Color yellow, greenish around the base, variegated with a few red spots. Stem equalling the base and set in a wide depression. Calyx rather large; depression small and shallow, plaited, plaits prominent, numerous, and extending over the sides. Skin thick. Flesh yellowish white, firm subacid. Core small.

The ridged pippin is a fine fruit, and was exhibited at New-York by Mr. John Perkins. It is a late fall apple.

81. FRENCH PIPPIN. Plate 45, Fig. 1. Fig. 28.



Fruit above the medium size, circular, symmetrical. Color green, yellowish green enlivened with a few red blotches around the base. Stem short, rising half way to the base; depression wide. Calyx small and inclosed in deep depression. Core small. Flesh yellowish, tart and juicy.

A good second rate apple. Exhibited at the Horticultural Rooms in Albany, January 1849. Late fall or early winter.

82. SUMMER BROADEN.

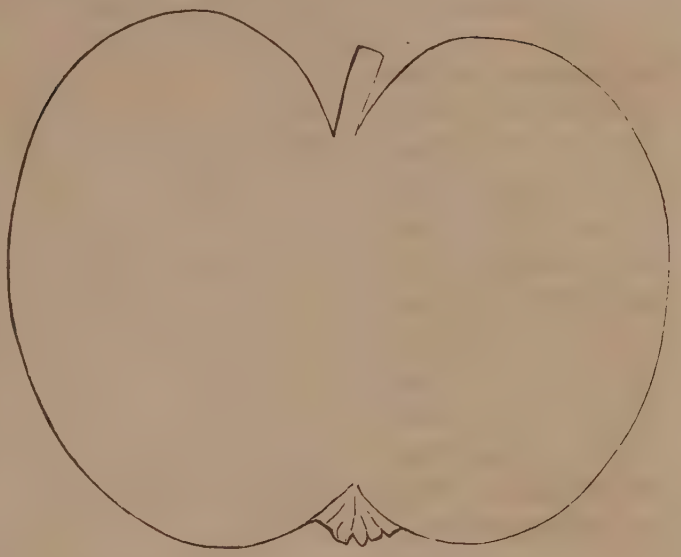
Summer Colmar.

Fruit above the medium size, sub-angular. Color dull green, and tinged with a dull brown on the sunny side. Stem short and slender, subequaling the base; deeply inserted, Calyx small and closed; depression narrow. Flesh greenish white, subacid. An English apple well known in the county of Norfolk.

83. WALTHAM ABBEY SEEDLING (Hort. Trans. Vol. v, p. 269).

Fruit of the medium size, globular. Color pale yellow, and deepens as the fruit ripens, and becomes enlivened with deep scarlet on the sunny side; skin specked with greenish dots, and patched with russet near the stem. Flesh yellowish, soft, juicy and sweet. An English seedling, which ripens in October and keeps till christmas.

84. FALL HARVEY. Plate 74. fig. 2. Fig. 29.



Fruit exceeding the medium size, symmetrical and circular. Color yellow, enlivened with orange. Fair. Stem subequaling the base. Calyx large connivent.—Depression quite shallow. Calyx tube open. Flesh firm, yellowish, and juicy. Subacid. Core open. Taste when over ripe, sweetish.

Exhibited in New-York in 1848, by Mr. Earle of Worcester, Mass. It it is a fine and valuable apple.

85. NELSON'S CODLIN.

Fruit about the medium size, subangular at the sides. Color pale lemon yellow; on the sunny side, bright golden yellow. Flesh yellowish white, tender, saccharine, or only subacid. English.

86. RYMER APPLE. (Hort. Trans. London, vol. iii. p. 329.)

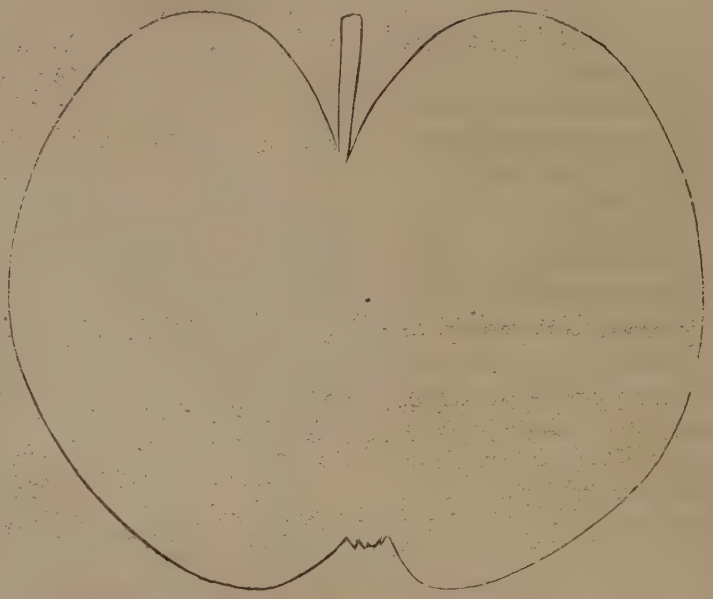
Fruit of the medium size, and larger. Form irregular; angular; angles obsolete at base, but prominent at the crown. Calyx open, deeply seated in an oblique depression. Stem short; depression shallow. Color pale yellow, ornamented with salmon, and dull carmine on the sunny side. Flesh pale yellow, tender, subacid; flavor brisk. Becomes rich when baked. Raised in Yorkshire, Eng.

87. TRANSPARENT CODLIN. (Lind. Cat.)

Fruit of the medium size. Color bright yellow, enlivened with salmon on the sunny side. Stem short, slender, inserted in a deep and wide excavation. Fair. Flesh tender, in favorable seasons translucent.

An English apple, well known in Norwich.

88. HAWLEY. Plate 24. Fig. 30.



Fruit above the medium size; circular, symmetrical, fair. Color yellow, sparsely dotted. Stem equaling the base, and deeply inserted. Calyx rather large; depression shallow, and plaited. Flesh yellowish white, subacid, rich. Core open and large. Regarded as first rate by J. J. Thomas. Ripe in Obtober.

89. DUTCH CODLIN. (Hort. Soc. Cat. of London.)

French Codlin, Glory of the West.

Fruit above the medium size; pentangular; angles extending from the base to the crown. Color yellow; ornamented when fully ripe with orange. Stem short and thick. Calyx small. Flesh white, dry, subacid, inclining to sweet.

An English apple, but deficient in quality.

90. LYMAN'S PUMPKIN SWEET.

Fruit above the medium size; angular. Angles more prominent upon the base. Color pale green. Stem short. Calyx small, in an abrupt depression. Flesh white, sweet, tender; rather dry. Used for baking.

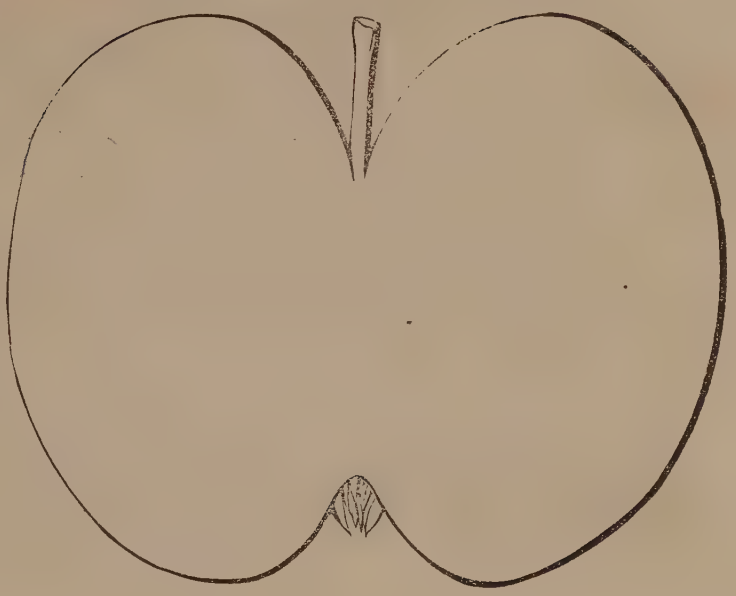
91. DOWNTON PIPPIN.

Elton's Pippin, Knight's Pippin, etc.

Fruit of the medium size; symmetrical. Color yellow. Skin dotted; fair. Flesh yellowish, crisp, rich; subacid.

An English fruit, ripening in October and November.

92. HOLLAND PIPPIN. Fig. 31.



Fruit above the medium size. Yellow. Its character differs somewhat from the fall pippin. It is a better keeper, with higher flavor; and may be regarded as a winter apple.

CLASS III. *Fruit russet or semi-russet.*

ORDER I. Height and breadth equal or subequal.

A. Ends equal or subequal.

B. Ends unequal.

93. PUMPKIN RUSSET. SWEET RUSSET.

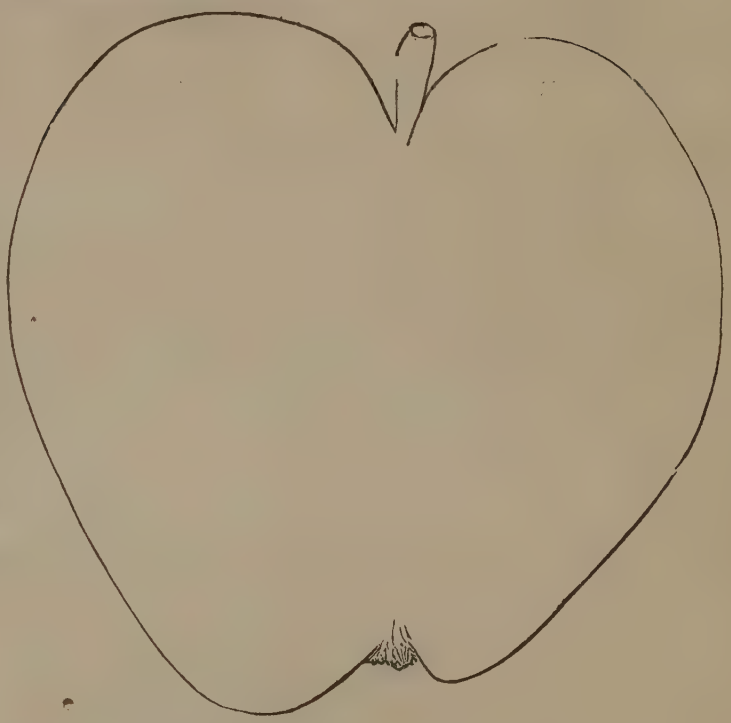
Fruit rather exceeding the medium size. Color yellowish green. Semi-russet. Stem depression wide. Calyx depression shallow and small. Flavor rich and sweet. Entends through autumn.

94. PINE APPLE RUSSET.

Fruit above the medium size, elongated. Color pale greenish yellow. Skin marked with white specks on one half; scabrous russet on the other. Flesh pale yellow; crisp, juicy, aromatic, spicy.

An excellent English apple.

95. CHEESEBOROUGH RUSSET. Plate 20. Fig. 32.



Fruit above the medium size; elongated, circular, tapering from above the middle to a narrow crown. Stem never exsert, thick and strong. Calyx depression shallow. Color russet, faintly tinged with orange on the sunny side. Flesh yellowish, saccharine, dry. Core large. Second rate.

Exhibited New-York Convention, 1848.

96. EARLY NONPAREIL.

Fruit of a medium size, elongated; stem slender. Color yellowish, incrusted with a thin russet interspersed with gray specks. Flesh yellowish white, crisp, tender, juicy and rich. Aromatic.

English, and raised in Norfolk.

97. DOWELL'S PIPPIN. (Hort. Trans. Lond. vol. v. p. 268.)

Fruit rather below the medium size; eccentric like the Ribston pippin. Color greenish, covered with a clear thin russet. Stem short, and depression deep. Flesh yellowish, subacid, crisp; rich and moderately juicy.

English. A cross by Mr. Knight between the Orange pippin and the Golden pippin. Ripens in October.

ORDER II. Breadth greater than the height.

A. Ends equal or subequal.

98. SCARLET CROFTON. (Hort. Trans. Lond. vol. iii. p. 453.)

Fruit of the medium size, depressed. Color yellowish russet; on the sunny side bright red. Stem short. Flesh firm, crisp, juicy, saccharine.
Irish. Ripens in October.

99. BRADDOCK'S NONPAREIL. (Hort. Trans. Lond. vol. iii. p. 268.)

Fruit of the medium size, depressed. Color greenish upon the base; yellowish brown and russetty near the crown; fair and smooth. Flesh yellewish, juicy and sugary.
English.

B. Ends unequal.

100. ROSS NONPAREIL. (Hort. Trans. Lond. vol. iii. p. 454.)

Fruit medium size; circular. Color russet, stained brown. Stem long, exsert. Flesh firm, greenish white, sweet, and richly perfumed.
Irish. Ripens in November and keeps till April.

101. BOWYER'S RUSSET.

Fruit rather small, conical; stem half an inch long. Calyx depression small. Flesh greenish white, tinged yellow. Aromatic; rich.

102. PITMASTON RUSSET. (Hort. Trans. Lond. vol. v. p. 267.)

Fruit of the medium size, depressed. Color greenish russet, and faintly brown on the sunny side. Stem short, inserted deeply. Flesh greenish, but inclined to yellow. Juicy and rich. Aromatic.
English. A valuable fruit.

III. WINTER APPLES.

SYNOPSIS OF THE VARIETIES.

CLASS I. *Fruit red or striped; mottled or splashed with red or brown.*

ORDER I. Height and breadth equal or subequal.

A. Ends equal or subequal.

MOTHER. Large. Elongated. Subangular. Base narrowed. Stem exsert.
BUCK MEADOW APPLE.
PENNOCK'S RED WINTER. Oblong; oblique; obtuse. Depressions wide.

B. Ends unequal.

BAILEY'S SWEET. Medium size. Subangular. Apex narrow.
KAIGHN'S SPITZENBURNH. Rather large. Stem long, slender.
WINTER PEARMAIN. Medium size; elongated. Stem exsert and slender.
NEWARK KING. Size medium. Conical. Fair. Striped red upon a yellow ground.
RED BELLE FLEUR.
JONATHAN. Medium size. Symmetrical. Stem slender.
MINISTER. Medium size. Angular or ribbed. Crown or apex narrow.
SWEET PEARMAIN. Medium size. Rich red. Dotted. Stem long.
BLACK GILLIFLOWER. Full medium size. Conical. Stem long. Dark colored.
CORNISH GILLIFLOWER. Medium size. Apex ribbed, narrow.

ORDER II. Breadth greater than the height.

A. Ends equal or subequal.

B. Ends unequal.

DOCTOR. Medium size. Symmetrical. Stem and calyx deep.
HOARY MORNING. Large. Stripes broad. Hoary.
KENTISH FILLBASKET. Very large. Slightly angular.
MURPHY. Full medium size.
ROCKREMAIN.
POUND. Very large. Stem short.
GOLDEN REINETTE. Small. Symmetrical. Stem long, in a shallow depression.
HARTFORD SWEETING. Full medium size. Stem slender. Depression shallow.
NEWTOWN SPITZENBURGH.
WATSON DUMPLIN. Very large. Symmetrical. Stripes faint.
WINE APPLE. Medium size. Stripes obscure. Mottled. Stem short.
CAMPFIELD. Rather less than medium size. Skin yellow in spots.
KING APPLE.
COURT PENDU. Medium size. Stem short. Crimson.

Hubbardston's Nonsuch. Medium size. Stem exsert. Depression wide.
Richfield Nonsuch.
Black Detroit. Medium size. Depressed. Very dark skin.
Phillips' Sweeting. Large; symmetrical; mottled red.
Sweet Baldwin. Medium size; Symmetrical. Stripes indistinct.
Black Apple, of Coxe. Small, dark red, nearly black.
Carthouse. Medium size. Subangular. Stem exsert.
Eustis. Rather large; roundish; stem very short.
Limber Twig. Large; dull red.
Lucombe's Seedling. Rather large; subangular. Stem short.
Marston's Red Winter. Large; symmetrical; slightly narrowed at each end.
McLellan. Medium size; regular; smooth. Stem slender.
Pryor's Red. Medium size; unsymmetrical and irregular. Stem long.
Winter Queen. Medium size; base broad. Crimson.
Chandler. Large. Oblique. Subangular. Stem rather short.
Apple of the Well.
Cornish Gilliflower. Medium size. Apex ribbed narrow.
Domine.
Wine Sap.
Mark's New Spitzenburgh.
Margil. Very small. Angular. Yellow orange, striped with red.
Blue Pearmain. Large. Purplish red in broken stripes.
Stevens' Gilliflower. Large; oblique. Stem very short.
Westfield Seeknofurther. Size nearly medium. Conical. Striped with dull red, slightly russetted.
Red Calville.
Cos, or Caas. Above the medium size; unsymmetrical. Stem short.
Northern Spy. Often exceeds the medium size. Conical. Stem moderate in length. Depression wide.
Herefordshire Pearmain. Medium size. Stripes indistinct.
Claygate Pearmain.
Flushing Spitzenburgh.
English Sweeting. (Sweet Pearmain.)
Red Raunce.
Blenheim Pippin. Large. Stem short Sweet.
Court of Wick. Below the medium size. Symmetrical. Stem short.
Priestly. Medium size. Dotted. Dense bloom. Stem long.
Black Apple. Small. Dark Red. Mealy bloom.
Golden Reinette. Small. Stem long. Depression shallow.
Dutch Mignome. Medium size. Russetted slightly. Stem long, slender.
Barcelona Pearmain. Medium size; elongated. Skin uneven.
Borsdorffer. Small. Stem short, slender. Depression shallow.

Vandervere. Medium size. Dotted. Stem short, in a wide depression.
Brabant Bellefleur. Large. Calyx large. Pale yellow, and striped.
Wagener. Medium size. Obscurely ribbed, Stem equals the base. Slender. Depressions wide.
Winter King. Large; bright crimson; striped; yellow patches about the base.
Redstreak. Medium size. Red and yellow in streaks. Cider apple.
Monmouth Pippin.
Baldwin. Full medium size. Circular. Stem slender.
American Pippin. Medium size. Symmetrical. Colors dull.
Esopus Spitzenburgh. Full medium size. Conical. Stem slightly exsert. Deprnssion wide. Calyx depression abrupt.
Melon. Medium size. Unsymmetrical. Stem long, slender.
Ribston Pippin. Medium size. Elongated. Basin angular. (Late autumn or early winter.)
Fameuse. Medium size or less. Stripes and blotches on a whitish ground. Stem long. (Autumn or winter.)
Ramsdel Sweeting. Medium size. Stem short. Depression deep. Sweet. Skin bloomed.
Red Gilliflower. See Scolloped Gilliflower.
Ladies' Sweeting. Full medium size. Crown or apex narrow. Stem short. Depression small.
Kirke's Lord Nelson. Large. Symmetrical. (Autumn or winter.)
Willow Twig. Full medium size. Symmetrical. Depressions wide and deep.
Ohio Nonpareil. Large. Stem short.
Stannard's Seedling.
Dutch Mignome.

Class II. *Fruit yellow, or yellow with an orange blush; green, or green with a brown blush.*

Order I. Height and breadth equal or subequal.

A. Ends equal or subequal.

Salisbury's Winter. Fruit nearly of the medium size. Stem exsert, small; depression closed.
Warren Pippin.

B. Ends unequal.

Yellow Bellfleur. Full medium size, or greater. Apex narrow.
White Bellfleur.
Michael Henry. Medium size. Apex narrow. Stem short, thick.
Cornish Gilliflower.
Waxen Apple. Unsymmetrical.
Lowell. Medium size. Elongated. Yellow.
Lemon Pippin. Scarcely medium size. Symmetrical. Stem short. Fleshy. Curved inwards.

ORDER II. Breadth greater than the length.

A. Ends equal or subequal.

FRENCH PIPPIN. Medium size. Symmetrical. Depressions deep.
CANADA PURSEMOUTH.

B. Ends unequal.

CANN. Medium. Conical. Shaded brown. Sweet.
CUMBERLAND SPICE. Conical. Surface specked.
AUNT HANNAH ?
GOLDEN PIPPIN. Small. Skin marked with cross bars. Stem long.
YELLOW VANDERVERE. See RUSSETS.
WINTER QUEEN. Medium size. Deep crimson cheek. Stem thin.
WOOLMAN'S LONG.
MARLE CARLE.
MOUSE. Large. Stem slender, long.
REINETTE CANADA. Large. Unsymmetrical.
NONPARIEL. Rather small. (See RUSSETS.)
COURT OF WICK. Small. Depressed. Wide, shallow basin.
DOWNTON PIPPIN. Small. Stem sort. Calyx wide.
FALLAWATER.
WHITE VANDERVERE.
YELLOW NEWTOWN PIPPIN. Medium size. Oblique depressed.
GREEN NEWTOWN PIPPIN. Resembles very much the Yellow Newtown Pippin.
PECK'S PLEASANT. Large. Stem very short, thick, deeply inserted.
VICTORIOUS REINETTE. Large. Symmetrical. Tapering.
STURMER'S PIPPIN.
WINTER SWEET PARADISE.
WHITE PIPPIN. Large. Unsymmetrical.
WESTERN SPY.
DUMILOW'S SEEDLING. Medium size; stem very short.
WOOD'S GREENING ? Large; oblique-angled; stem short.
WHITE CALVILLE. Large. Unsymmetrical. Depressions deep.
CATSHEAD. Large. Elongated. Angular.
BEDFORDSHIRE FOUNDLING. Above the medium size. Green. Stem short.
DANVERS WINTER SWEET. Medium size. Elongated. Obscurely angular. Stem long.
FENOUILLET JAUNE. Small yellow russetty veins. Stem short.
ROMAN STEM. Medium size. Stem with a fleshy protuberance.
SURPRISE. Flesh deeply stained red.
TALMAN SWEETING. Medium size. Stem long. Sweet. Yellow.
PARADISE PIPPIN.
BEACHAMWELL SEEDLING.
COCKLE PIPPIN. Medium size. Angular. Tapering.

King of the Pippins. Medium size. Stem long. Basin deep.
St. Julien.
Golden Ball. Above the medium size. Angular. Stem short.
Harrison. Cider apple.
Orbs Apple.
Seedling Newtown Pippin. (*Slingerland.*)
Pearson's Plate.
White Spanish Reinette.
Swaar. Full medium size. Depressed. Circular.
Newtown Spitzenburgh.
Tewksbury Winterblush. Small. Red cheek.
Victuals and Drink. Full medium size. Unsymmetrical. Stem short.
Styre.
Court Pendu. Medium size. Depressed. Basin wide.
Cranberry Pippin. Full medium size. Circular. Dotted red.
Easter Pippin.
Fenouillet Rouge. Small. Flattened. Symmetrical. Stem short.
Lady Apple. Small. Symmetrical. Deep crimson cheek. Depressed.
Norfolk Beaufin. Large. Flat. Copper colored. Stem short.
Rhode-Island Greening. Full medium size. Green. Blush brown.
Wells Sweeting. Medium size; tapering to both extremities.
McLean's Favorite.
Green Sweet. Medium; symmetrical; stem long, stout. Sweet.
Old Town Crab. Rather small; sweet.
Fort Miami. Uneven; angular. Stem long.
Loudon Pippin. Large; stem very short.
Pickman. Large; round.
Sweet and Sour. Medium size; ribbed.
White Seeknofurther. Subangular; stem short.
Winter Cheese. Medium size.
Leicester Sweeting. Large; depressed.
Moore's Late Sweet. Large; depressed.
American White Winter Calville. Large; depressed.
Shawmut. Small; round.
Orange. Small; yellow.
Norfolk. Small; depressed.
Table Greening. Medium size.

Class III. *Russet or semi-russet.*

Order I. Height and breadth equal or semi-equal.

A. Ends equal or subequal.

Aromatic Russet? Medium size. Stem very short; inserted deep.
Knobby Russet. Medium size. Stem short. Skin warty.
Siely's Mignone. Small. Skin gray russet and netted.
Cooper's Russeting. Small; elongated.

B. Ends unequal

Farmer's Crab Apple.
Ashmead's Kernel. Small. Obtuse angular. Longer than Old Nonpariel.
Brodwell. Large; greenish yellow; stem short. Sweet.

Order II. Breadth greater than the height.

A. Ends equal or subequal.

B. Ends unequal.

Red Russet. Large; depressed.
Win Russet. Large; depressed. Dark russet.
Sweet Russet. Large. Apex narrow.
Pomme Grise. Small. Stem slender.
Fenouillet Gris. Small. Calyx small. Form slightly flattened.
Golden Harvey. Small. Unsymmetrical.
Old Nonpariel. Rather small. Greenish yellow. Pale russet.
Golden Russet. Medium size. Circular.
Boston Russet. Roxbury Russet. Medium size. Skin rough russet. Circular.
Sam Young. Small. Bright yellow. Semi-russet.
Shippen's Russet. Large; tapering to the apex.
Skyehouse Russet.
American Golden Russet.
Acklam's Russet. Small. Circular. Depressed.
Pine Apple Russet. Large. Angular. Stem long.
Powell's Russet. Small. Depressed.
Reinette de Hongrie. Medium size. Circular. Stem short.
Wheeler's Russet. Medium size. Form irregular.
White Russet. Medium size. Angular.
Jersey Crab. Small. Greenish gray. Grow in clusters.
English Russet. Medium size. Symmetrical.
Bourassa. Large. Angular. Stem long.

Golden Harvey. Small; regular. Stem slender, one-half inch long.
Cornish Aromatic. Large. Crown angular.
Morton's Nonpareil.
Ross' Nonpareil. Medium size. Circular Stem long.
Royal Russet. Medium size, or large in the middle. Depressed.
Hughes' Golden Pippin. Below the medium size.
Gray French Reinette.
Yellow Vandervere. Full medium size. Semi-russet.
Pomfret Russet. Below the medium size. Greenish gray russet.
Horsham Russet. Less than the medium size. Stem short.
Patch's Russet. Medium size. Slightly angular. Stem long.
Pennington Russet, or Seedling. Large. Sides slightly angular.
Pile's Russet. Above the medium size. Form irregular. Angular.
Pitmaston Russet. Medium size. Depressed. Stem short.
Scarlet Nonpareil. Medium size. Basin shallow. Stem variable.
Sweeney's Nonpareil. Form irregular, and larger than the old Nonpareil.

DESCRIPTION OF WINTER APPLES.

Class I. *Fruit striped, mottled or splashed with red or brown.*

Order I. Height and breadth equal or subequal.

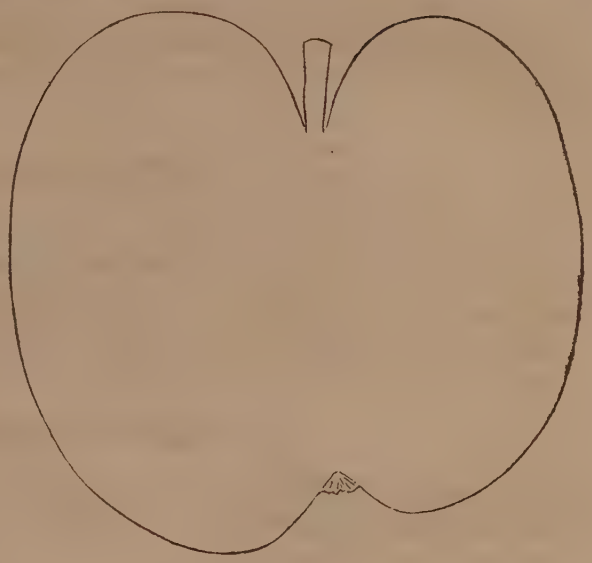
A. Ends equal or subequal.

1. MOTHER APPLE.

Fruit above the medium size, elongated, slightly ribbed. Stem rises from a moderately deep and broad depression, above the base, and has a knob at its base, or fleshy protuberance. Ground color yellow and blazed with carmine; skin marked with russetty dots. Flesh yellowish, tender, melting; taste mildly acid, rich, with an aromatic flavor.

The Mother Apple originated more than forty years ago, in the orchard of Gen. Sawyer, of Boston Massachusetts. It is highly recommended by the Boston Cultivator. In form it resembles the yellow bellefleur, and like that has a large hollow core. Exhibited for the first time at the Worcester Horticultural Society, in 1845. Height and breadth subequal; side unequal; red. Late fall and early winter.

2. BUCK MEADOW APPLE, Fig. 33.



Fruit of the full medium size, rather eccentric or sub-circular; sides approaching to parallelism, basal margin wide and rounded, crown, subequaling the base, with one side extended. Color red or carmine, in stripes. Stem short below the base. Calyx large; depression shallow.

Received from Mr. D. S. Browning, and is supposed to have originated in Norwalk, Connecticut. It is a good second rate apple. New.

3. PENNOCK. Plate 45.

Fruit above the medium size; unsymmetrical; circularity broken by large ridges. Color dull crimson, or brown crimson; dark crimson, variegated with patches of green and russet about the base, which imparts a dirty or faded appearance: dotted grey. Stem short, slender. Depression deep, narrow. Abrupt margin, rounded. Calyx small; depression shallow; tube to the core closed. Core small. Flesh greenish yellow, rather coarse. Flavor defective, scarcely subacid. Some of the dots upon the skin spread into moderately sized patches.

This apple in Ohio, is a good market apple, although it ranks only as second rate.

B. Ends unequal.

4. BAILEY'S SWEET.

Patterson Sweet. Edgerly Sweet.

Large, regular ovate, slightly ribbed. Color red, spread over the whole surface, nearly, in small, broken, indistinct stripes and dots, on a bright ground. Stem slender, long; depression narrow, slightly ribbed; basin small plaited. Flesh tender, pure, mild, rich, sweet, fine. Early winter.

Originated in Perry, Wyoming county, N. Y.

5. KAIGHN'S SPITZENBURGH.

Fruit of the full medium size; oblong, or ends subequal; subcircular. Color red in stripes, more or less diffuse upon a yellow ground. Stem short, depression narrow. Calyx in a shallow depression. Flesh white; firm, juicy, sweet or nearly so, and fine.

6. WINTER PEARMAIN.

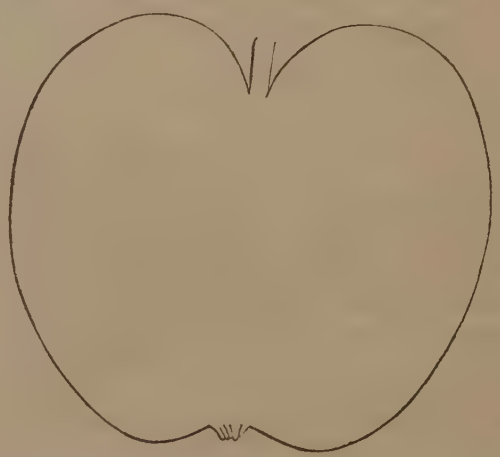
7. NEWARK KING.

Fruit of the medium size, fair. Color yellow, ornamented with red stripes. Flesh tender, yellowish white; pleasant and rich. Early winter. New-Jersey.

8. RED BELLE FLEUR. Fig. 34.

Fruit of the medium size; smooth, circular, symmetrical, elongated. Color red, striped; paler around the calyx; both depressions rather shallow and wide. Calyx large. Russet around the stem. Flesh white, tender, juicy. May be ranked as second rate.

Exhibited at the Horticultural rooms, 1849. The stem is exhibited as broken.



9. JONATHAN. Plate 25.

Fruit of the medium size, circular, fair, slightly elongated, but the ends are subequal. Color deep carmine in stripes, and paler about the apex; variegated with open patches of yellow. Stem short, subequaling the base; depression deep, margins abrupt but rounded, borders without plaits. Flesh yellow, fine, juicy and rich, equaling the Spitzenburgh. Keeps through the winter. The tree is productive.

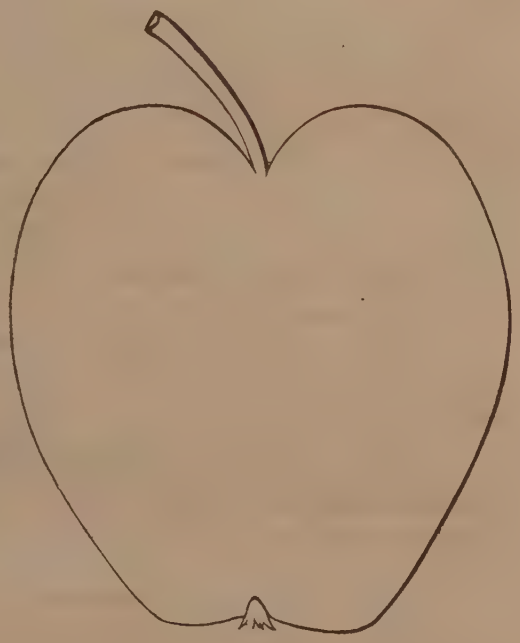
10. MINISTER.

Fruit large, fair, unsymmetrical, ribbed; base wide and tapering to a narrow apex. The ground color, yellowish green; ornamental color, carmine pencilled in stripes. Stem long, slender, inserted in a wide shallow irregular depression. Flesh yellowish white, subacid, moderately rich. Tree productive.

11. SWEET PEARMAIN. (English Sweeting of Rhode-Island.)

Fruit of the medium size. Color dark, rich crimson, and marked with rough dots. Stem slender, inserted in a wide depression; basin small; taste sweet.

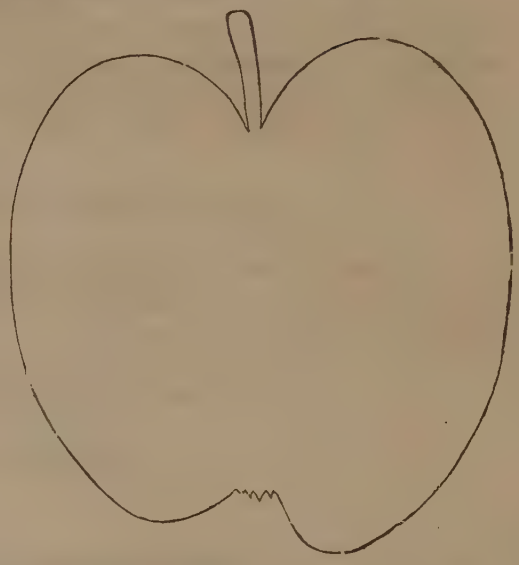
12. BLACK GILLIFLOWER. Plate 24. Fig. 85.



Fruit of the medium size, elongated; subangular; conical; symmetrical. Color dark crimson, and dull, obscurely striped; stem exsert, depression very narrow, calyx small; depression shallow, plaited, almost truncate. Flesh greenish white, subacid, rich; over ripe, very mealy and dry.

This apple, though less esteemed than formerly, yet being a distinct variety and adapted to the taste of many, should find a place in every orchard.

13. CORNISH GILLIFLOWER. Plate 56. Fig. 36.



Fruit about the medium size; circular; elongated. Color green, and green ornamented with faint patches of brown upon the cheek. Stem exsert; slender. Calyx small; depression plaited. Flesh white, and scarcely tender.
English.

Order II. Breadth greater than the height.

A. Ends equal or sub-equal.

14. DOCTOR.

Fruit of the medium size; symmetrical. Ground color yellow, ornamented with stripes more or less nebulous. Stem and calyx inserted in deep depressions. Flesh yellowish, tender, and aromatic. Taste subacid, accompanied with a fine flavor.

Originated in Pennsylvania. It is said to lose its finer qualities at the North. Late autumn or early winter.

15. HOARY MORNING.

Fruit full medium size; roundish. Color red, arranged in wide stripes, bearing a bloom. Basal depression wide; that of the crown superficial. English cooking apple,

16. KENTISH FILLBASKET.

Fruit very large, rounded and slightly ripped. Predominant color, greenish yellow, faintly striped. Subacid. English cooking apple.

17. MURPHY.

Fruit rather large, or full medium size; round-oblong. Ground color a rich yellow, bearing bright red stripes. Stem long; depression wide; basin narrow. Flesh yellowish, subacid, mild and pleasant. Early winter. Origin, Salem, Mass.

18. ROCKREMAIN.

Raule Jannet. Neverfail

Fruit medium size, elongated, and tapering to the crown. Color greenish yellow, ornamented with red stripes. Flesh fine, yellowish, juicy.; taste subacid, sprightly. Keeps till May or June.

This apple requires a long season for ripening: as it blossoms two weeks later than most apples it is unsuited to a northern summer. It is a valuable fruit for the southern markets.

19. POUND.

Fruit exceeding the medium size; striped red on a greenish yellow ground. Stem short. Depression wide. It is regarded as only third rate.

20. GOLDEN REINETTE.

Fruit below the medium size; slightly elongated; symmetrical. Color yellow, cheek red, stem long, basin shallow. Flesh yellowish, subacid, pleasant. Early winter.

21. HARTFORD SWEETING.

(Spencer Sweeting.)

Rather large, roundish, depressed; striped red, on a greenish yelow ground. Stem slender; depression shallow. Calyx large; basin shallow. Sweet, juicy rich, productive, and keeps a long time. Hartford, Conn.

22. NEWTOWN SPITZENBURGH.

Fruit of the medium size; circular; symmetrical. Ground color yellow, or yellowish green, shaded deeply with red in stripes upon the sunny side; skin dotted about the apex. Stem short. Flesh firm, yellowish, rich and juicy. Fine; deserving of cultivation.

23. WATSON'S DUMPLIN.

Fruit above the medium size; large, yellowish green, and faintly striped; juicy, subacid, pleasant, and used for cooking.

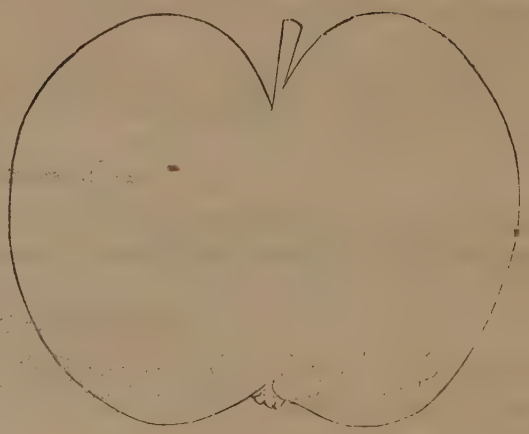
24. WINE APPLE.

Hay's Apple.

Fruit full medium size; large. Ground color yellow, which is ornamented with red stripes and nebulous patches. Stem short; depression deep. Calyx large, open. Flesh yellowish white, with a rich subacid and somewhat vinous flavor.

25. CAMPFIELD Fig. 37.

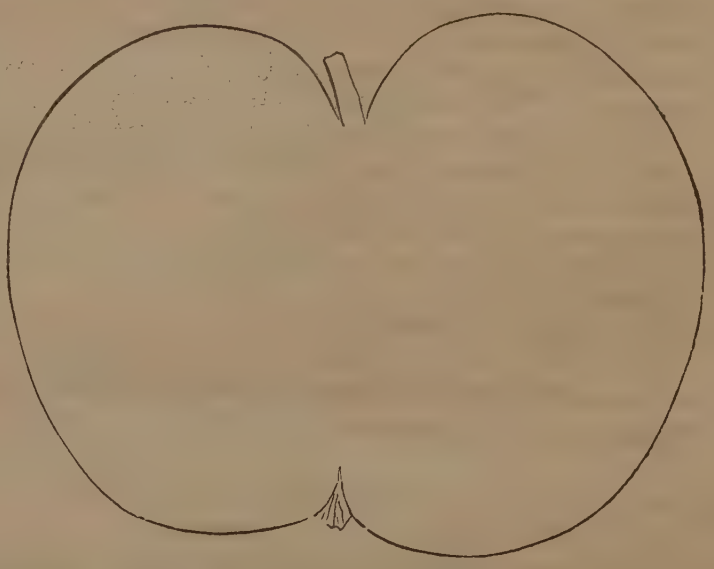
Newark Sweeting.



The fruit is rather less than the medium size; symmetrical; fair, smooth. Color red and somewhat marked with yellow spots. Flesh white, firm, sweet.

This is the celebrated New-Jersey cider apple, and was exhibited by Dr. Ward, at the Horticultural exhibition in Albany, 1849.

26. KING APPLE. Fig. 38.



Fruit above the medium size; depressed, wide, tapers from the middle. Color, carmine in stripes, upon a yellow ground. Yellow about the base; greenish around the stem. Stripes paler upon and around the apex. Stem short, not reaching the margin of the base; depression rather deep. Calyx rather small; closed depression shallow. Flesh rather coarse, and similar to that of the 20 oz. pippin. Subacid.

This apple is a good keeper, and is a beautiful fruit in form and color; yet it ranks no higher than second rate for the table.

27. COURT PENDU.

Court Pendu Plat.

Fruit of the medium size; circular. Color greenish yellow, and deep red on the sunny side. Stem short, deeply inserted. Flesh rich and lively.

Of French origin, and esteemed for the dessert. Keeps till March.

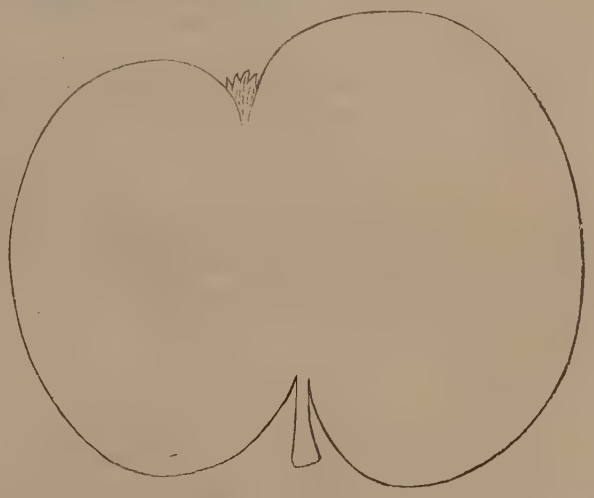
28. HUBBARDSTON NONSUCH. Plate 51.

Fruit of the medium size; elongated, symmetrical. Color yellow, ornamented with bright crimson stripes; paler upon the shady side, showing the yellow ground beneath. Stem equalling the base. Depression wide and deep. Calyx open; depression plaited. Flesh white and tender. Very juicy; rich flavored. Core small; calyx tube closed.

This apple has been regarded as a standard fruit, and worthy of cultivation. It is allied very close to the Spitzenburg family. An apple known by some as the Hubbardston Nonsuch, is a wide depressed fruit, but which in other respects is related to it, and can scarcely be distinguished by its taste and flavor.

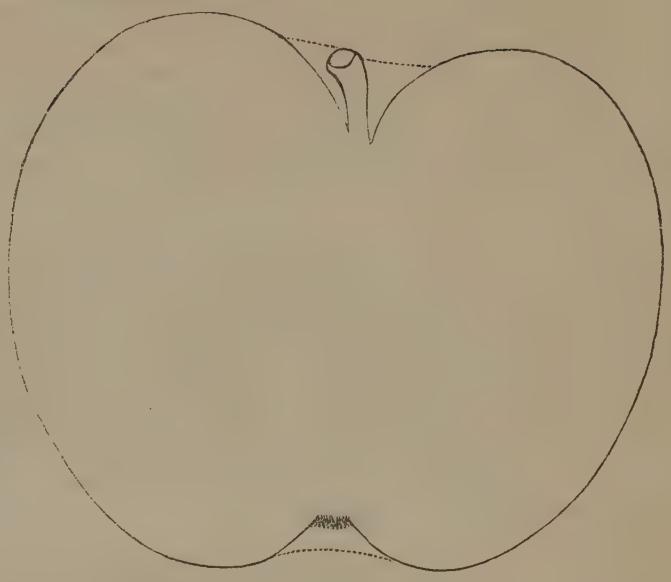
29. BLACK DETROIT. Plate 56. Fig. 39.

Fruit of the medium size; depressed, circular; widest in the middle; ends equal. Color a dark crimson, darkest on the sunny side, even blackish. Skin smooth, with a few yellowish dots; the yellow appears through the dark stripes. Stem equaling the base; slender. Calyx large, depression shallow, obsoletely plaited. Flesh fine-grained, subacid, agreeable, but not juicy. It does not rank higher than second rate, yet is very fine when in its best state.



Exhibited at Buffalo in 1848, by Elwanger & Barry.

30. PHILLIPS' SWEETING. Fig 4.



Fruit above the medium size; base broad, and tapering from near the middle: much wider than high. Stem deep, nearly equaling the base, but does not project. Depression regular. Calyx rather small; depression rather broad, open and shallow, but not deep. Color red, and striped and mottled upon a yellow ground; darkest upon the base. Flesh yellowish, tender, juicy and crisp, with an agreeable flavor. Ripens in November and keeps till March.

This apple is an Ohio seedling, and supposed to have originated in Coshocton. It is described in the Ohio Cultivator for March 15, 1847, and in the Horticulturist for February. The tree is described as an annual and prolific bearer, vigorous and upright in its growth. It is regarded as valuable for culinary purposes, and by many as one of the best of sweet apples. Transactions of the Ohio Fruit Convention, for 1847.

31. SWEET BALDWIN.

Fruit of the full medium size; symmetrical; rather elongated. Color red in indistinct stripes, ornamenting a yellow ground. Stem of a medium length; slender. Basin small. Flesh yellowish white, tender, juicy, and fine. Early winter.

32. BLACK APPLE (*of Coxe.*)

Rather small, dark red or nearly black; skin covered with a whitish mealy bloom.

33. CARTHOUSE.

Fruit below the medium size; subsymmetrical; apex flattened. Color striped and shaded on a yellow ground. Stem rather long, slender; basin slightly plaited, wide. Flesh tough, crisp, agreeable; mildly acid.

Market apple for New-Orleans, sent from the Ohio valley.

34. EUSTIS.

Fruit rather large, roundish; striped and dotted with carmine spread upon a yellow ground. Stem short; basin narrow, deep. Flesh yellowish, subacid, fine. Essex Co., Mass.

35. LIMBER TWIG.

Fruit of the medium size. Color dull red. Flesh yellowish white, close and compact. A southwestern apple, noted for its keeping qualities.

36. MARSTON'S RED WINTER.

Fruit of the medium size; oval, symmetrical, narrowed at each end; smooth, striped with crimson on a yellow ground. Stem of the medium length, slender. Depression russeted. Basin abrupt and smooth. Flesh yellowish white, tender; high Flavored. New-Hampshire.

37. McLELLAN.

Fruit of the medium size; roundish, smooth, symmetrical. Color, lively clear red; stem rather long, slender; depression narrow; basin narrow waved. Flesh white, fine-grained, very tender; subacid, agreeable. Productive. Connecticut.

38. PRYOR'S RED.

Medium size; unsymmetrical. Apex broad, but variable. Subangular. Color dull brick on a greenish yellow ground. Stem variable; depression small. Flesh tender, rich subacid. Western states.

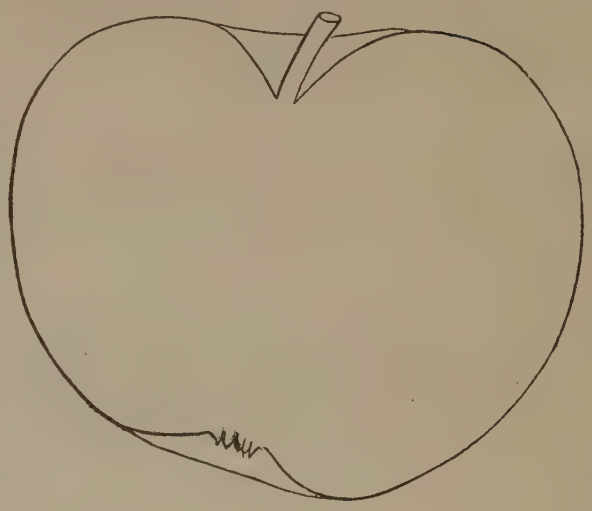
39. WINTER QUEEN

Fruit of the medium size; conical, base broad. Color, deep carmine in the sun; pale in the shade. Stem slender, rather long; depression wide. Flesh yellowish, mild, subacid, pleasant, and productive. Early winter. New-Jersey.

40. CHANDLER.

Fruit large, unsymmetrical, oblique and irregular. Color greenish yellow, shaded with broken stripes of yellowish red. Stem short; depression deep, Flesh greenish yellow, subacid, rich, better than second rate. Ripens in early winter.
Originated in Pomfret, Connecticut.

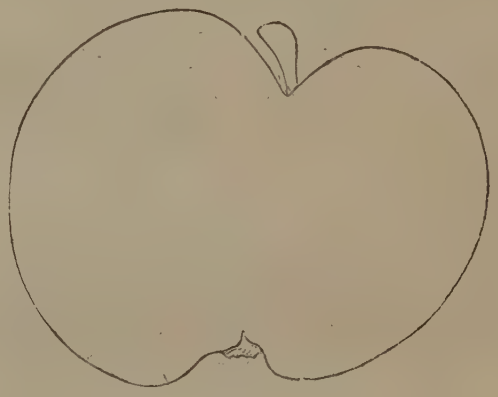
41. APPLE OF THE WELL, OR WELLS APPLE. Fig. 41.



Fruit of the medium size, depressed but tapering from the middle to the crown; unsymmetrical. Stem equals the base. Calyx rather large and surrounded by a very low crown. Color bright yellowish green, blazed on the sunny side with red. Flesh white, tender, juicy; taste subacid, with a sprightly flavor. Excellent for baking, and when gathered early keeps till March.

Tree has a spreading top, and grows vigorously and bears every year.

42. DOMINE, OR WILLIAMSON APPLE. Fig. 42.



Fruit of the medium size; color red striped yellow, and sparsely striped on two-thirds of the surface. Stem rather slender, equalling the base. Depressions deep. Flesh yellow, lively, tender, spicy. The fruit is fine for eating, and the tree a steady bearer.

The figure was taken from an undersized specimen. It has been known in some of the southern counties under the name of Williamson apple, and was exhibited as a seedling at the agricultural rooms in 1849.

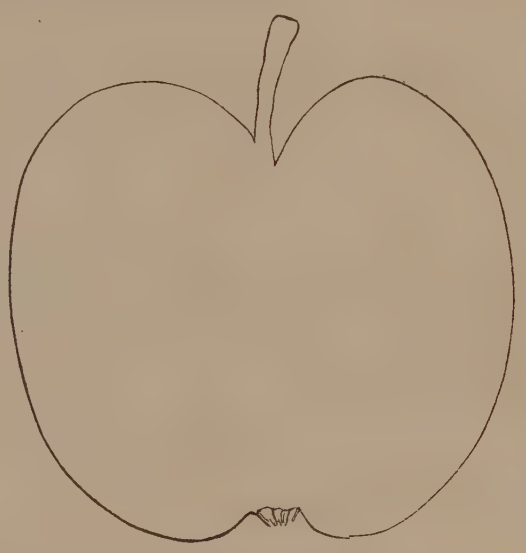
43. WINE SAP.

Fruit of the medium size, slightly elongated, fair skin predominant. Color fine red. Stem slender; depression small towards the apex. Calyx small, plaited. Flesh yellowish, firm, crisp, with a subacid and slightly vinous taste.

The following is a description of a MARYLAND WINE SAP:

Color red, almost uniform, paler about the apex and deeper in patches around the base, which gives a nebulous shade to the surface. Flesh yellowish. Keeps till late, preserving also its fine flavor under unfavorable circumstances.

44. MARK'S NEW SPITZENBURGH. Fig. 43.



Fruit of the medium size, elongated, symmetrical; sides quite straight. Color yellow, bearing bright red stripes. Stem long, projecting beyond the base. Base and crown rounded. Calyx small, and both depressions shallow. Flesh yellowish, tender, spicy and rich.

This new variety was raised from the seeds of the Esopus Spitzenburgh, by Judge THOMPSON of Catskill, Greene county, N. Y. Its size is rather less than the Esopus Spitzenburgh, but it is more spicy; its red is brighter and the skin is less dotted. The tree grows more upright, aud its limbs never droop. The fruit keeps remarkably well.

45. MARGIL.

Fruit below the medium size, small and angular; striped and mottled with red on a yellow ground. Flesh firm, aromatic and high flavored. English.

46. BLUE PEARMAIN.

Fruit full medium size; sides inclining to parallelism. Ground color light red, splashed with broad purplish stripes, bearing a bloom. Surface dotted; stem rather long. Calyx resting in a deep depression. Flesh yellowish, mild, subacid, and pleasant.

Less productive than the Westfield Seeknofurther.

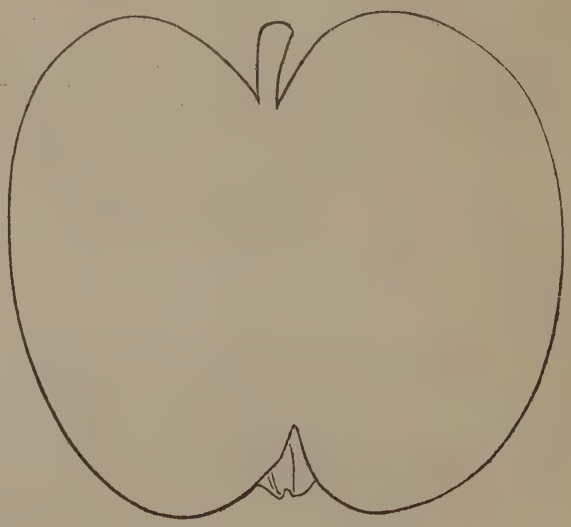
47. STEVENS' GILLIFLOWER.

Fruit large, elongated; depressions shallow: ground color, whitish; ornamental color, red in stripes. Flesh white, tender, pleasant, subacid. From November till February. Tree productive. Originated in Maine.

48. WESTFIELD SEEKNOFURTHER. Fig. 44.

Fruit of the medium size, or rather less; slightly elongated. Color mostly red, or dull red, arranged in stripes which are rather obscure; sometimes russeted. Stem rather long and slender. Flesh tender, rich and finely flavored or spicy.

This apple ranks high in New-England, where it succeeds remarkably well. The tree is uniformly productive, bearing at the same time fair fruit and a good yield.



49. COS OR CAAS.

Fruit of the medium size, subangular, base wide, tapering to a narrow apex. Color greenish yellow, ornamented with red stripes. Stem short; depression deep, unsymmetrical. Calyx small and surrounded by a shallow margin. Flesh subacid, pleasant.
Originated in Kingston, New-York.

50. NORTHERN SPY. Plate 23.

Fruit of the medium size, sometimes depressed; sub-angular. Color red in stripes, ornamenting a yellow ground. Stem and calyx inserted in deep depressions. Flesh fine grained, subacid, usually possessing the finest qualities for the table, conjoined with an ability to preserve a soundness and perfection until spring.
Tree grows erect and vigorous; young branches dark. A native of East Bloomfield, N.Y.

51. HEREFORDSHIRE PEARMAIN.

Royal Pearmain.

Fruit of the medium size; sides approaching to parallelism, oblong. Color red, arranged in indistinct or nebulous stripes upon a yellow ground. Stem short; depression small. Calyx large, open; depression narrow, plaited. Flesh yellowish white, fine grained, subacid; flavor fine.

52. CLAYGATE PEARMAIN. (Hort. Trans. vol. v. p. 402.)

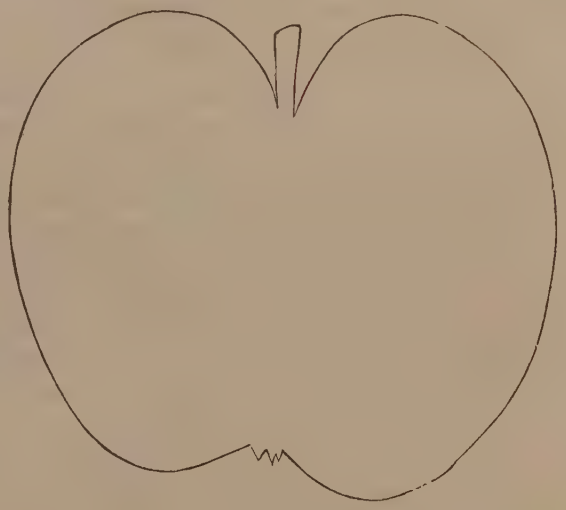
Fruit of the medium size; ground colors dull yellow, painted with carmine in broad stripes. Flesh yellowish white, rather dry, but sugary and rich. English.

53. FLUSHING SPITZENBURGH.

Fruit rather large, base rounded, tapering only moderately to the apex. Ground color yellowish green, ornamented with red stripes. Calyx small. Flesh white, more sweet than sour; pleasant, but ranking only as second rate.

54. RED RAUNCE. Plate 57. Fig. 45.

Fruit of the medium size, elongated; subcircular; one side lengthened. Color, carmine stripes, with distinct dots of gray. Dots elongated on the base. Stem slender, equaling the base. Calyx small, depression shallow, plaits few. Flesh white, or white and stained reddish; tender; core small. Apple allied to the Spitzenburgh. Exhibited by E. T. Headley, in New-York, 1848.



55. BLENHEIM PIPPIN.

Fruit large, tapering. Ground color yellowish, stained on the sunny side with a dull red and intermixed with deeper stripes. Flesh yellowish, sweet, juicy and high flavored. English dessert apple.

56. COURT OF WICK.

Fruit below the medium size, ovate; apex slightly angular. Color greenish yellow, with bright orange on the sunny side, and marked with small russetty dots. Stem short, small. Flesh pale yellow and mixed with green.
Excellent, English; raised from the seed of the golden pippin.

57. PRIESTLY.

Fruit of the medium size, rounded. Color red, in narrow stripes; skin marked with many dots and bloomed. Stem long; basin small and plaited. Fine flavored and spicy.

58. GOLDEN REINETTE.

Fruit less than the medium size, slightly elongated, though flattened at base. Stem long; basin shallow. Flesh yellowish, rich, subacid. Early winter.

59. DUTCH MIGNOME.

Fruit above the middle size; circular, symmetrical. Ground color, suborange; dotted and marked with nebulous stripes of a bright red; slightly russeted. Stem long, slender. Calyx large, open. Basin large, round, even. Flesh fine. In ripening becomes tender, with a rich acid flavor. Holland.

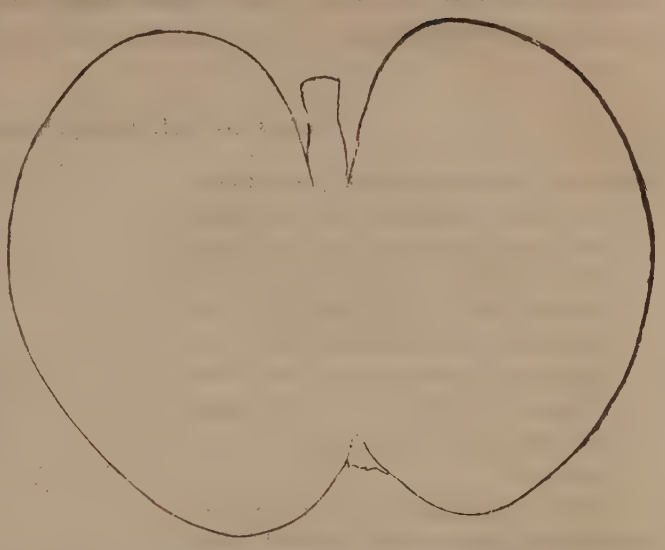
60. BARCELONA PEARMAIN.

Fruit of the medium size, circular, elongated. Color brownish yellow on the shaded, but a deep warm red upon the sunny side; surface uneven and marked with russetty spots. Stem short, fleshy on one side. Flesh yellowish, firm, aromatic, subacid. English.

61. BORSDORF, OR BORSDORFFER.

Below the medium size; apex conical; ground color pale yellow, ornamented with a full red cheek. Stem short, small. Basin very shallow, and small even. Flesh firm and crisp. Early winter. Germany.

62. VANDERVERE. PLATE 58. FIG. 46.



Fruit about the medium size, fair, subcircular, and symmetrical; ends nearly equal and tapering from the middle. Color yellow, and blazed with bright carmine stripes; yellow predominating at the apex. Skin marked with distinct dots of yellow and spots of yellow upon the base and within the stem depression. Stem short, scarcely equaling the base. Depression eccentric as well as that of the calyx. Calyx large. Flesh yellow, fine, juicy and crisp.

Few apples excel the Vandervere, either for the dessert or cooking. In market it is found of variable qualities, and sometimes defective.

63. WAGENER APPLE. PLATE 41.

Fruit of the medium size, or above. Subangular; tapering from near the middle to the crown. Stem rather long, deeply inserted; depression somewhat regular; calyx rather deep; depression round without plaits, shallow: segments of the calyx mostly closed. Color carmine, obscurely striped; deeper around the base, and greenish russet deep in the stem depression: crown roughish, faintly russet, and slightly tuberculated; with faint dots of whitish; paler on the shaded side. Flesh yellowish, tender, juicy, fine grained; subacid, aromatic.

The Wagener ranks among the best of the New-York winter apples, and will probably succeed in any part of the New-England states.

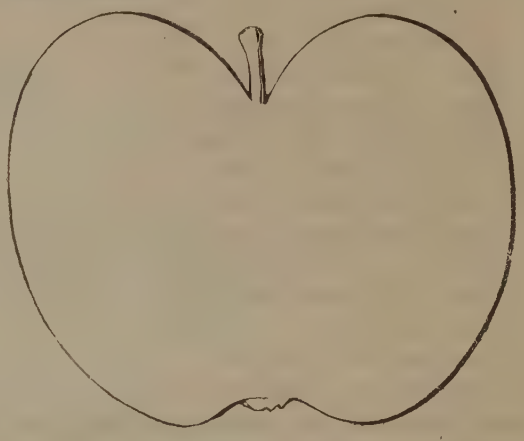
64. WINTER KING. PLATE 38.

Fruit of the medium size; base broad and rather flattened. Angular, tapering rapidly from the middle to the crown. Color bright crimson, showing the pale yellow ground in patches. Stem equaling the base; stout, depressed rather wide and deep. Calyx medium size, placed in a small depression. Flesh yellowish white, subacid, pleasant. Core open and, in some instances, defective. Tree strong and productive.

This apple, both in outward beauty and intrinsic excellence, ranks in the first class.

It has a close resemblance to the Wagener, though larger, but is inferior in flavor. It originated in Tompkins county, N. Y. It is highly probable that this apple will bear exportation, as it keeps well and has a very fine appearance.

65. ENGLISH REDSTREAK. Fig. 47.



Fruit of a full medium size; subangular and symmetrical; furnished with broad ribs, extending from the base to the apex. Color yellow, and blazed with carmine, which is paler upon the base. Stem equaling the base, slender. Calyx large; depression shallow. Flesh yellowish, rather dry. Only second rate, but possesses a fine outward appearance.

Exhibited at Albany, at the Horticultural show, in the winter of 1849. Specimens from Waterloo.

66. MONMOUTH PIPPIN. Plate 57.

Fruit of the medium size; symmetrical, circular, depressed or flattened at the apex. Color greenish, with a rusty greenish surface about the apex, dotted; base ornamented with diffused stripes of rather pale crimson. Calyx rather large, depression shallow, subcircular, and plaited; plaits numerous. Flesh with a greenish tinge.

The Monmouth pippin is a New-Jersey apple, possessing fine qualities. Exhibited at the New-York Convention in 1848.

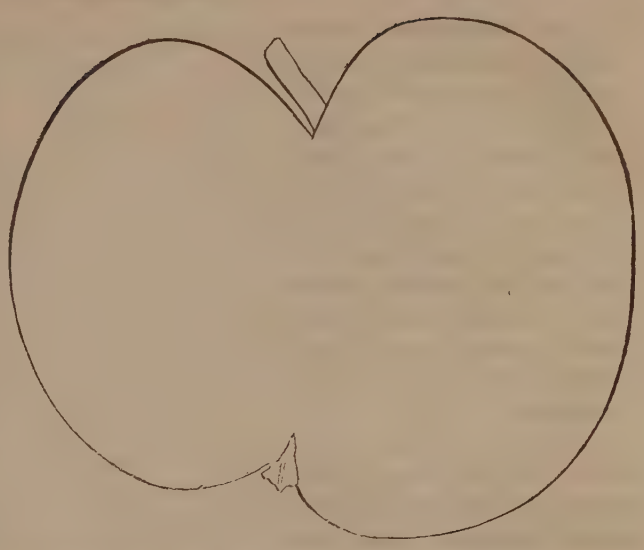
67. AMERICAN PIPPIN.

(*Grindstone.*)

Fruit of the medium size; symmetrical. Color greenish, bearing a light dull red; dots rather distinct. Stem short; basin shallow; flesh hard.

May be cultivated for its long keeping, but not for its eating or cooking qualities.

68. BALDWIN. Fig. 48.



Fruit full medium size; circular. Color of the ground yellow, broadly splashed with carmine; skin dotted with yellow. Stem bent, scarcely equaling the base; depression rather deep. Calyx depression shallow, plaited. Flesh yellow, juicy, subacid, rich and tender. The figure was taken from a specimen less regular than common.

The Baldwin ranks first among apples, or is equal to the Esopus Spitzenburgh, from which it is easily distinguished by its more depressed form, and the roundness of its dots.

69. LATE BALDWIN. (Boston Cultivator, vol. ix. 1847.)

The differences which are enumerated as distinguishing the Late Baldwin from the Baldwin, are: fruit hard, a little coarse, and better keeper, and superior for cooking; is flatter, and of a brighter red. It has been cultivated in Maine, by the late Mr. Pierce of Baldwin.

Remarks upon the above paragraph. As represented the Baldwin has a longer stem, deeper depressions and tapers more to the crown than the Late Baldwin. They both belong to the same section, and undoubtedly are closely related to each other.

70. RIBSTON PIPPIN.

Fruit of the medium size; large striped, and clouded red upon a yellow ground. Stem short, small; depression wide. Flesh granular and rich.

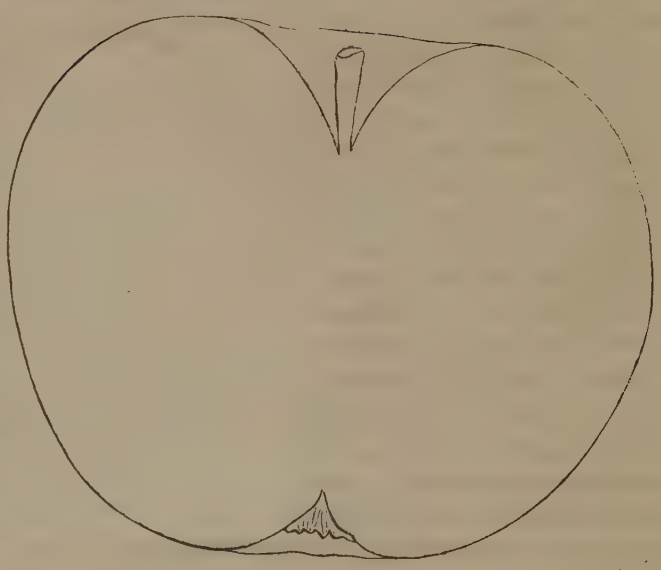
English. Succeeds best in Maine.

71. LADIES' SWEETING.

Above the medium size, with a narrow crown and apex; striped red on yellowish green ground, the stripes on the same becoming diffused of an even deep tint. Stem short; both depressions small. Juicy and rich.

72. MELON.

Fig. 49.



Fruit full medium size, circular and symmetrical; broad at base, widest in the middle. Color yellow, ornamented with bright crimson stripes. Stem scarcely equaling the base, deeply inserted. Calyx of a medium size; depression shallow and plaited. Flesh white, tinged slightly with red. Subacid, juicy; calyx tube closed; core of the medium size.

This apple is closely allied to the strawberry family, tho' more acid. Ripens in November and December. Exhibited in New-York, 1848.

73. RAMSDELL'S SWEETING.

(Ramsdell's Red Pumpkin Sweet.)

Fruit of the medium size, elongated, subcircular, symmetrical. Color dark red, bloomed. Stem short; basin deep. Flesh yellowish white, sweet and rich. A valuable sweet apple, from its intrinsic qualities and the productiveness of the tree.

74. RED GILLIFLOWER.

Fruit of the medium size, depressed; pentangular, or five-lobed, lobes unequal. Color yellow, ornamented with pale crimson stripes. Stem moderate exsert; calyx large, open, and leading to a large open core. Flesh yellowish white, tender, rich, subacid, and juicy. A very superior fruit. The tree, however, is said to be uncertain in its bearing.

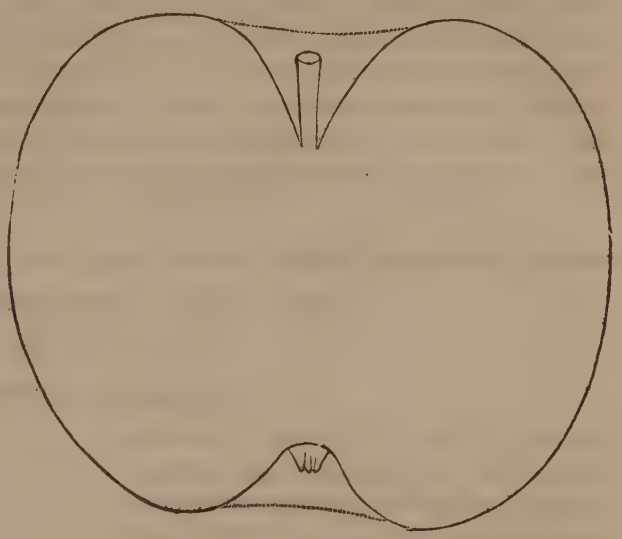
75. KIRKE'S LORD NELSON.

Large, symmetrical. Color yellow, with light red stripes. Acid, flavorless, but handsome. English.

76. WILLOW, OR WILLOW TWIG. (Trans. of Ohio Convention of Nurserymen.) Fig. 50.

Fruit above the medium size, slightly elongated, with a wide base; fair, regular and smooth. Stem short, below the base, and set in a deep depression. Calyx closed, and surrounded by a low crown. Color dull greenish yellow and blazed with pale red stripes.

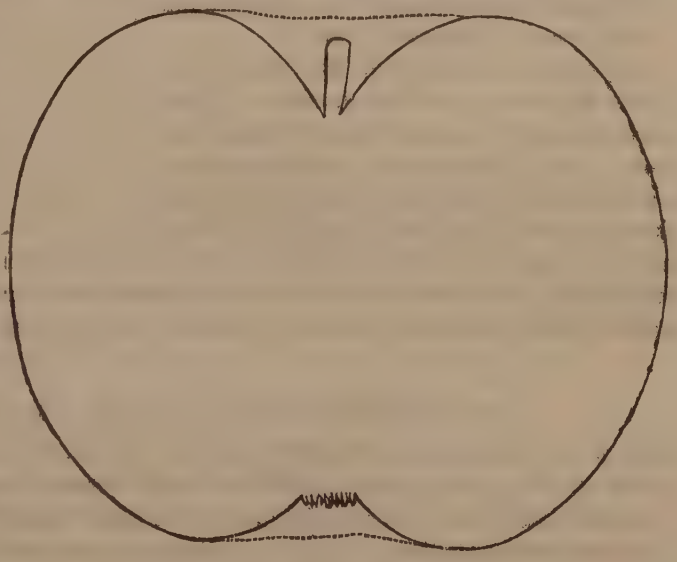
This apple is valuable for its keeping late, and is successfully sent to New-Orleans from southern Ohio.



77. OHIO NONPARIEL. (Transactions of the Nurserymen, etc., Ohio.) Fig. 51.

Fruit above the medium size; round, slightly depressed, and ribbed; stem subequaling the border of the base, and rather strong. Calyx large; depression of a medium depth and width. Color a rich yellow, striped with crimson; and when exposed to the sun, the red predominates and becomes a dark crimson. Flesh yellowish, crisp, and juicy; taste subacid.

The apple has a close resemblance to the Gravenstein, and ripens in October.



78. STANNARD'S SEEDLING.

Fruit of the medium size; subangular, depressed, base broad, narrowing rapidly from near the middle to the apex, which is narrow. Stem projecting from a wide depression; calyx large, depression shallow. Color red, with a base only faintly striped on a green ground: dots sparsely distributed over a slightly russeted skin. Flesh white, tender, juicy; vinous and pleasant, but not first rate. Calyx tube closed; core small. Keeps well, and retains its juiciness when long exposed to the air.

Class II. *Fruit yellow, or yellow with an orange blush; green, or green with a brown blush.*

Order I. Height and breadth equal or subequal.

A. Ends equal or subequal.

79. SALISBURY WINTER. Fig. 52.

Fruit nearly of the medium size; circular, or subcircular; oval; symmetrical; ends subequal. Color yellow, ornamental color, orange but faint. Stem short, slender, inserted near the base, the depression being very shallow. Calyx of the medium size, narrow, but deeper than the basal depression. Flesh tender, yellowish, juicy, subacid, and very pleasant; equals the Swaar.

This apple was brought to my notice by Mr. James H. Salisbury, of Cortland Co. It has been cultivated for many years by Nathan Salisbury, Esq., his father, an intelligent fruit-grower of that county, and has ever been esteemed as one of the best of apples. Having tasted this apple on several occasions, I must concur in this opinion. It may be a well known fruit, yet I have failed to discover a description in books which answers to its characters. The insertion of the stem is peculiar, and will lead at once to its recognition.

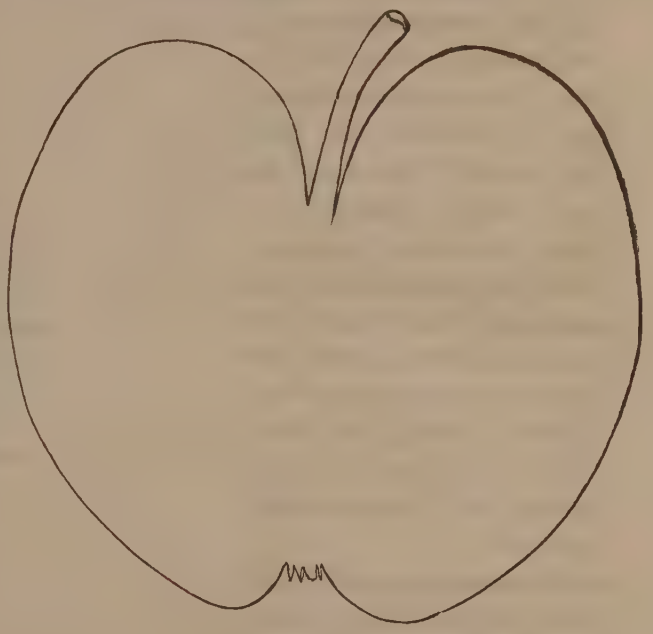
80. WARREN PIPPIN. Plate 54. (*Ortley—Van Dyme.*)

Fruit of the medium size, elongated; subangular, subcircular. Color green and greenish yellow. On ripening, ornamented with a deep brown blush, interrupted by one or more patches of green or yellowish green near the base; skin dotted; stem rather short. Calyx depression shallow, narrow and plaited; plaits rather large. Flesh white, tinged greenish; crisp, perfumed, excellent. Tree productive.

The apple here described, and of which a figure is given, was exhibited at New-York in 1848, as the Warren Pippin. It does not, however, agree with the description furnished by pomologists; yet I am inclined to regard it as the apple described by Mr. Hoy in 1825, and which Mr. Downing regards as Woolman's Long.

B. Ends unequal.

81. YELLOW BELLEFLEUR. Fig. 53.



Fruit above the medium size; sub-pentangular, elongated, tapering from about the middle. Color yellow. Sunny side enlivened with a crimson blush if exposed, or spotted with oblong crimson spots. Stem slender, exsert; depression wide; crown narrow, enclosing a large calyx; depressions marked with about five plaits. Flesh yellowish white, tender, juicy, crisp. Core open, and rather large, and liable to mouldiness. It is a fine apple, and quite uniform in Maryland and New-York.

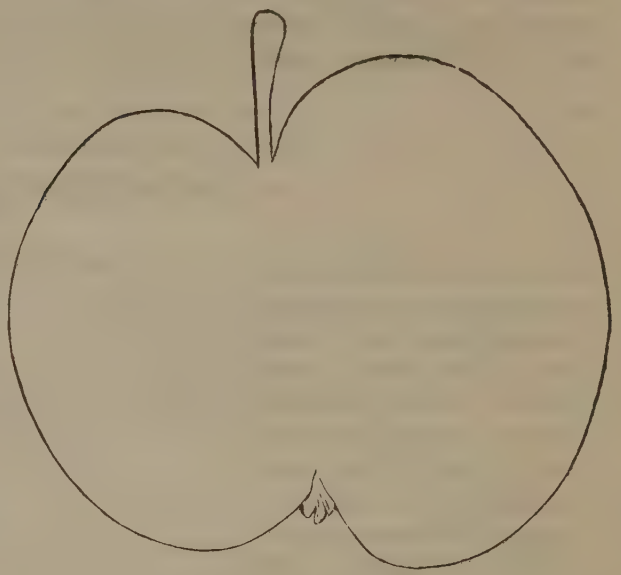
82. MICHAEL HENRY.

Fruit attaining the medium size, or nearly so; elongated, narrow towards the crown. Color green, and yellowish green; stem short, rather thick; basin small. Flesh yellow, tender, juicy, and high flavored. New-Jersey.

83. LEMON PIPPIN. Plate 81.

Fruit below the medium size; symmetrical; elongated. Color, when ripe, bright yellow. Stem short, fleshy, and inclined to be curved. Basin small, flesh firm, subacid and pleasant. Early winter; a hard yellow apple, but not first rate. Early winter.

84. BELMONT, GATE, OR WAXEN (Fig. 1 and 2.) Fig. 61



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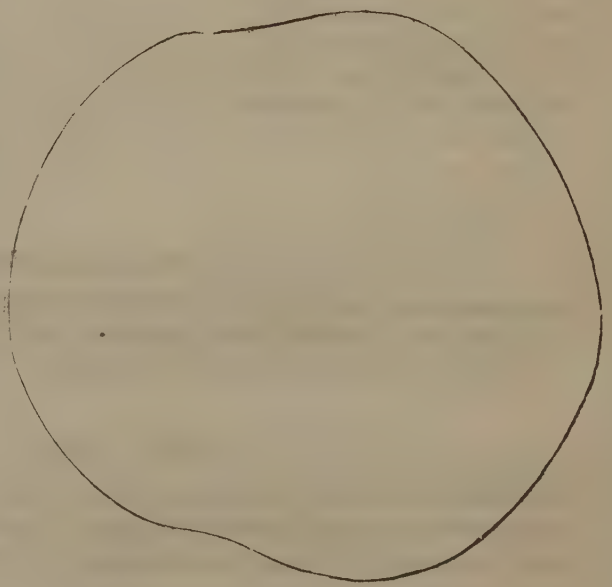


Fruit of the medium size, irregular and unsymmetrical, tapering to both extremities from the middle. Color golden yellow, uniform, fair, skin resinous. Stem long, slender, high above the base. Calyx moderate, tube open, depressions irregular.—Flesh juicy, high flavored with nasturtion. This variety is quite distinct and stands by itself. The calyx tube being open, renders it liable to defects at the centre. Ohio. Fig. 2, transverse section, showing the sub-pentangular tendency.

The specimens which have fallen under my notice were always *unsymmetrical*. Perhaps the figures give distorted views, yet they seem to be generally correct.

The apple is very fine for the dessert, and is well worth cultivating.

ORDER II. Breadth greater than the length.

A. Ends equal or subequal.

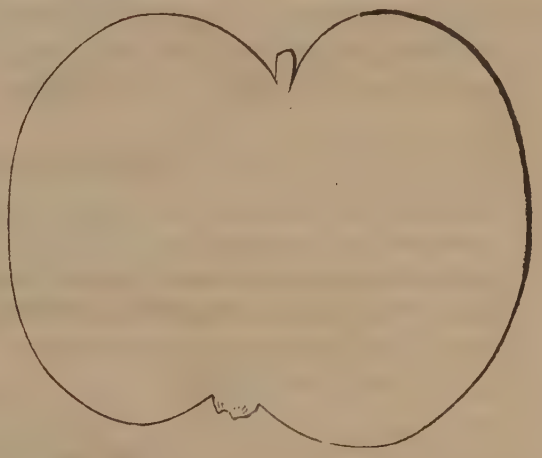
85. FRENCH PIPPIN. PLATE.

(*Newark Pippin.*)

Fruit of the medium size; subcircular, depressed. Color green, cheek browned, skin sparsely dotted with green. Stem short, thick, below the base; depressions wide. Calyx rather large, closed; depression of the calyx plaited; core small. Flesh tender, rich, pleasant. Ripens in early winter. Growth of the tree unsymmetrical. New-Jersey. Exhibited by Gideon Ross, at the New-York Convention, in 1848.

86. CANADA PURSEMOUTH. Fig. 55.

Fruit about the medium size, subcircular; color yellow, with a large patch of crimson upon its cheek; slightly ridged; stem short, with the flesh closing the depression. Calyx rather large; depression shallow. Flesh white, tender, juicy, but not all sprightly. Skin tough. Open from the calyx to the core. Fruit second rate.



B. Ends unequal.

87. CANN.

Fruit of the medium size; conical. Color green, enlivened with a shade of brown around the base or near the stem. Very sweet. Early winter.

88. CUMBERLAND SPICE.

Fruit full medium size; conical; base rather broad, from which, or near to which it begins to taper. Color waxen yellow, ornamented about the base with a tinge of vermilion red. Skin marked with black dots. Stem equaling the base. Depression wide; calyx set in a small basin. Flesh white, subacid. Color of the apple is similar to the Maiden's blush. Early winter.

89. AUNT HANNAH.

Fruit of the medium size, roundish; straw yellow. Flesh mild subacid, with a fine flavor. This apple originated in Essex county, Mass.

90. GOLDEN PIPPIN.

Fruit small, circular, symmetrical. Color rich yellow. Skin marked with cracks in the form of crosses. Stem long, slender. Basin yellow. Flesh yellow, rich, subacid, fine flavor. It keeps till spring. English.

91. WINTER QUEEN.

Fruit of the medium size, elongated; base broad. Color deep crimson, without stripes; in the shade paler. Stem slender, rather long; depression wide. Flesh yellowish, mild, subacid, pleasant. Productive. New-Jersey.

92. MARLE CARLE.

(Mal Carle.)

Fruit less than the medium size; circular; symmetrical. Color waxen yellow, or clear yellow, faintly mottled with green, or marked with nebulous patches of greenish clear crimson on the sunny side. Stem long, slender; depression deep. Flesh white, delicate, sweet; rose-perfumed. Italian.

93. MOUSE, OR MOOSE.

Fruit large, conical. Color pale green, becoming greenish yellow, bearing on the sunny side a brownish blush. Stem long, slender; depression narrow; basin narrow, plaited. Flesh white, fine-grained, spongy, mild, subacid. Keeps till spring. Ulster county, New-York.

94. CANADA REINETTE.

Fruit above the medium size; depressed, unsymmetrical; coreal ribs irregular, terminating in a ribbed apex and depression. Color greenish yellow, and in the sun the cheek becomes brownish. Stem short; depression irregular. Flesh white, or nearly white; becomes tender, juicy, subacid and agreeable.

95. COURT OF WICK.

Fruit small, depressed. Color greenish yellow; cheek enlivened with orange. Stem short, calyx open, depression wide, shallow. Flesh crisp, juicy, high flavor, acid ; tree hardy. English.

96. DOWNTON PIPPIN.

Fruit small, yellow, stem short. Calyx depression wide and shallow. Rich acid. Late fall; scarcely early winter.

97. FALLAWATER. Plate 46.

Fruit of the medium size, elongated ; symmetrical, smooth. Color greenish yellow, shaded with a dull red. Skin sparsely dotted ; stem depression narrow, basin small. Flesh greenish white, fine grained, subacid. Early winter. Pennsylvania.

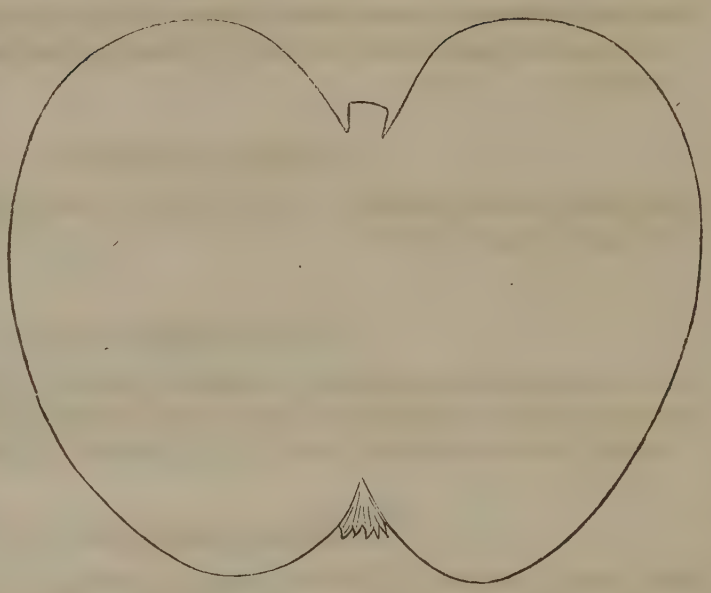
98. YELLOW NEWTOWN PIPPIN.

Fruit large, or somewhat greater than the medium size ; unsymmetrical, or oblique ; depressed. Color yellow ; cheek ornamented with brown, and purplish; stem very short, thick. Flesh firm, crisp, with a rich and agreeable flavor. It is regarded as rather inferior in flavor and goodness to the Green Newtown Pippin.

99. NEWTOWN PIPPIN, GREEN.

Fruit of the medium size, fair, depressed, subsymmetrical. Color yellowish green ; cheek ornamented with brownish crimson. Stem short, thick at the end, terminates below the base ; depression deep, with its margin regularly rounded. Calyx rather large, depression shallow, marked with obscure plates. Calyx tube closed. Flesh yellowish, firm, juicy, subacid. Regarded by all pomologists as first rate, when well cultivated and grown in a congenial climate. It requires a strong, rich clay soil. Originated in Newtown, L. I.

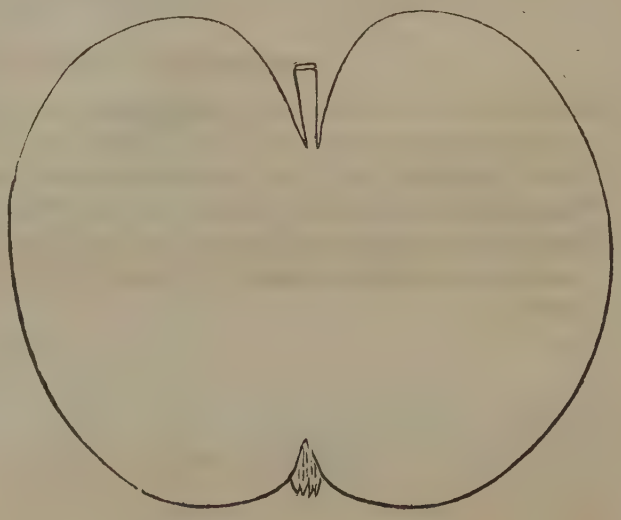
100. PECK'S PLEASANT. Fig. 56.



Fruit above the medium size; circular, elongated and narrow at the apex, tapering from the base. Color green, enlivened with a brown cheek. Skin variegated with dots. Stem very short, deeply inserted in a wide depression. Calyx rather large in a medium sized depression. Calyx tube closed. Flesh yellowish, juicy, fine, subacid.

The apple, in the estimation of the writer, is among the best early winter fruit. Exhibited in N. York, 1848.

101. VICTORIOUS REINETT. Plate 49. Fig. 57.



Fruit of the medium size, rather depressed, fair, subcircular, tapering from the middle in a circular sweep. Stem short, rather thick, below the base. Depression deep. Calyx small, depression shallow. Color pale yellow, dotted, and more on the sunny side. Flesh yellowish white, firm, subacid. A very good apple, and worthy of cultivation, but rather below the first rated fruit.

102. STURMER PIPPIN.

Fruit of the medium size, depressed, conical. Color yellowish green; in the sun, brownish red. Flesh firm, with a brisk, rich flavor. Tree vigorous; productive. Fruit keeps till mid summer. English.

103. WINTER SWEET PARADISE.

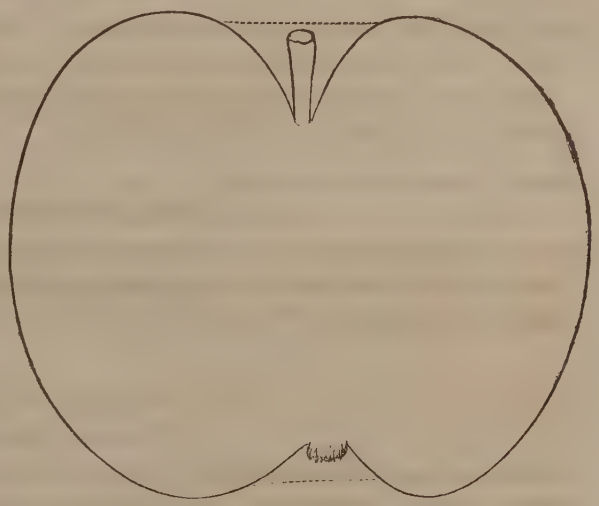
Fruit rather large, symmetrical, circular, fair, smooth. Color dull green, becoming in time brownish on the exposed cheek. Stem short; depression circular. Calyx depression small, shallow and narrow. Flesh white, fine grained and juicy.
Considered as a very good apple, and keeping until March.

104. WHITE PIPPIN.

Fruit large, irregularly ribbed, greenish yellow. J. J. Thomas expressed the opinion that it is identical with the Canada Reinette, celebrated in southern Ohio.

105. WESTERN SPY.

Fig. 58.



Fruit of the medium size, or above, broadest at the middle, slightly depressed. Stem deep and rather thick, subequaling the base. Calyx rather large, depression rather wide and of moderate depth. Color yellow; cheek upon the sunny side pale red or orange; skin dotted with gray. Flesh yellowish, agreeably acid with a good flavor. It is regarded as a seedling of Wayne, Jefferson county, Ohio, and is recommended for its hardiness and ability to withstand the late frosts of a southern climate. Keeps until March. [Transactions of the Ohio Fruit Convention, 1847.]

106. DUMELOW'S SEEDLING.

Fruit of the medium size; round, but somewhat depressed. Color yellow, ornamented with a clear carmine blush. Stem very short; calyx large, open, deeply implanted. Flesh yellow, crisp, acid. English; for cooking.

107. WOOD'S GREENING.

Fruit exceeds the medium size; depression deep (?) and somewhat irregular or oblique; smooth. Color pale green. Stem very short. Calyx rather large; depression plaited slightly. Flesh greenish white, fine grained, crisp, agreeably subacid.

108. WHITE CALVILLE.

Fruit large, angular; color yellowish green, or yellow, tinged with a crimson blush on the sunny side. Flesh white, tender, and pleasant. French.

109. CATSHEAD.

Costard Ray.

Fruit large, elongated, fair; ends subequal, triangular. Color pale green, tinged deeper on the sunny side. Flesh tender, juicy. For cooking.

110. BEDFORDSHIRE FOUNDLING.

Cambridge Pippin.

Fruit above the medium size; unsymmetrical; sides obtuse angled, unequal; apex oblique. Color pale greenish yellow, dotted on the shaded side with green; sunny side, pale orange. Stem short, deeply inserted; basin narrow. Flesh juicy, tender, white, subacid. Core large and hollow. English.

111. DANVERS WINTER SWEET.

Fruit of the medium size, large; obscurely angular. Color greenish yellow, running into dull rich yellow on ripening; sometimes ornamented with an orange blush. Stem rather long; cavity narrow. Flesh yellow, rich, sweet. Tree productive.

112. FENOUILLET JAUNE.

Embroidered Pippin.

Fruit of the medium size, globular, circular; greenish white, changing ultimately to a bright yellow. Flesh white, dry, rather tough; flavor perfumed.

113. ROMAN STEM.

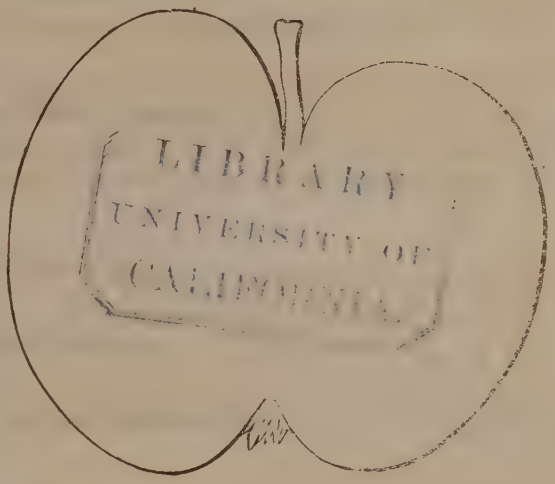
Fruit of the medium size; color whitish yellow, tinted brown in the sun. Stem rather long, fleshy on one side; depression shallow; basin narrow, slightly plaited. Flesh tender, juicy, subacid, and pleasant. New-Jersey.

112. SURPRISE.

A third rate apple, whose flesh is deeply tinged with red.

113. TALMAN'S SWEETING. Fig. 59.

Fruit of the medium size, fair, symmetrical, elongated, subcircular. Color golden yellow. Skin sparsely dotted. Stem long, slender, exsert. Depression deep, narrow at the bottom. Calyx small. Depression rather narrow, with an abrupt margin. Tube closed. Flesh white, tender, rather dry, sweet. One of the best of the sweet apples, when taken in connexion with its keeping qualities.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114. BEACHAMWELL SEEDLING.

Fruit below the medium size; color pale yellow, tinged with red on the sunny side. Skin sprinkled with dots. Stem short, thick. Flesh yellow, tender, and juicy; pleasant. English.

115. COCKLE PIPPIN.

White Cockle.

Fruit of the medium size, slightly angular and tapering. Calyx closed in a narrow depression; plaited. Stem rather short and slender. Color pale green, changing into bright yellow. Flesh yellowish white, saccharine, slightly perfumed.

116. GOLDEN BALL.

Fruit above the medium size; angular; color yellow; stem short, small; depression medium, and marked with radiating green rays diverging from the centre; basin shallow. Flesh tender, rich, aromatic.

It is regarded as a fine cooking apple. Tree unproductive, and prefers the north.

117. WHITE SPANISH REINETTE.

Fruit above the medium size, unsymmetrical; costal ribs irregular, terminating in an uneven apex. Color yellow, and when exposed the sun gives it a tinge of orange red. Stem rather of a medium length. Calyx rather large, open, and surrounded by an irregular basin. Flesh yellowish white, rich and sugary; crisp, tender. It resembles the fall pippin, but is less regular in form and keeps longer.

118. TEWKSBURY BLUSH.

Fruit small. Color yellow, enlivened with a red cheek. Flesh yellowish white, juicy and of a good flavor. Productive, and keeps till midsummer. New-Jersey.

119. HARRISON.

120. ORDS' APPLE.

121. SEEDLING NEWTOWN PIPPIN.

122. PEARSON'S PLATE.

123. SWAAR. Plate 22, fig. 2.

Fruit full medium size, slightly depressed, circular, symmetrical, fair. Color yellow, often tinged with orange near the base. Stem rather long, slender; depression narrow, circular, and even; basin shallow and small. Flesh yellowish, fine-grained, very rich, tender, juicy. One of the best of all apples, and succeeds well in the valley of the Hudson and Mohawk, but not equally well at all places.

124. VICTUALS AND DRINK.

Fruit large, unsymmetrical. Color dull yellow, slightly russeted. Stem long, slender. basin shallow and ribbed. Flesh rich, sweet, and fine grained. Early winter. New-Jersey.

125. CRANBERRY PIPPIN.

Fruit of the medium size, symmetrical, fair and smooth. Color yellow, enlivened with a fine blush, and red dots on the sunny side. Stem slender. Calyx deep set. Flesh white, subacid. Early winter. Quality medium.

126. EASTER PIPPIN.

Ironstone Pippin.

Fruit of a medium size, circular, color greenish and greenish yellow; skin dotted with white; stem slender, deeply inserted. Flesh greenish or yellowish white; hard. Keeps from autumn to autumn. A valuable fruit.

127. FENOUILLET ROUGE.

Fruit rather small, symmetrical, depressed. Color dark brown, red spread upon grayish ground. Stem short. Flesh firm and perfumed.

128. LADY APPLE. Plate 47.

Fruit small, symmetrical, circular, depressed. Color light clear yellow, ornamented with a brilliant crimson cheek. Sometimes irregular patches of yellow and red upon the base. Stem and calyx depressions deep. Flesh tender, delicate and subacid. A fine fancy apple. Productive.

A Lady apple of a black color, of the form and shape of the preceding, is met with and cultivated as a curiosity, but destitute of flavor.

129. SCARLET NONPAREIL.

Fruit of the medium size, symmetrical. Color yellowish green, beautifully enlivened with deep red on the sunny side. Stem thick. Flesh rich, and English.

130. NORFOLK BEAUFIN.

Large, depressed, dull, copper-colored; some faint stripes of dark red, and poor. English.

131. WELLS' SWEETING.

Fruit of the medium size, tapering; color light green; cheek brown; stem short; basin shallow. Flesh white, sweet, tender, pleasant. Newburgh, N. Y.

132. McLEAN'S FAVORITE.

It is an English apple, not long since received into this country, and noticed only by Mr. Downing: "Middle size, roundish, yellow, crisp, rich, with the flavor of the Newtown pippin."

133. RHODE-ISLAND GREENING. Plate 22, fig. 3.

Fruit of the medium size and greater; subcircular or scarcely angular, depressed or flattened, but nearly symmetrical. Color green and pale, mellowed with yellow and tinged brown in the sun upon the base. Skin fair, smooth and waxy, or showing a full development of chlorophyl in its texture. Stem exsert, depression moderate. Calyx small, depression shallow. Flesh yellowish, firm, juicy, fine grained, and becoming tender. For general purposes in New-England and New-York, it is one of the best. Keeps till March. Tree productive.

134. GREEN SWEETING.

Fruit about the medium size, elongated; one side more developed than the other. Color yellow, its cheek ornamented with a tinge of brown. Stem long, exsert. Calyx large. Flesh yellowish, pure, sweet, for which, along with its keeping qualities, it deserves a place in every orchard. Specimen figured, obtained at Syracuse.

135. OLD-TOWN CRAB.

Rather small. Color yellowish green, and marked with brown specks. Flesh sweet, crisp, greenish white, juicy and sprightly. This is the Virginia Spice apple; it keeps there until spring. Tree vigorous.

136. SWEET AND SOUR.

Fruit of the medium size, but characterized by numerous greenish ridges and whitish furrows. The former are subacid, while the latter are insipidly sweet. The apple is of little value, and unworthy of cultivation, except as a curiosity.

137. WINTER CHEESE.

Fruit of the medium size; color green; when exposed to the sun it has a red cheek. Flesh tender, with a pleasant flavor. It is esteemed in Virginia, where it is principally cultivated.

138. PICKMAN.

Fruit rather large, round, of a light yellow color, with the surface dotted. Flesh juicy and firm, having the property of keeping well, and adapted to culinary purposes.

139. WHITE SEEKNOFURTHER.

Fruit of the medium size, only slightly elongated; subangular. Color pale green, yellowish on ripening. Skin dotted, stem very short. Flesh fine grained, juicy, agreeably subacid. J. J. Thomas remarks that it is smaller and more delicate in texture than the Seeknofurther of Coxe.

140. MOORE'S LATE SWEET.

Fruit large, depressed. Color greenish; cheek brown. Flesh tender, sweet, and rich. Keeps until spring. Concord, Mass.

141. AMERICAN WHITE CALVILLE.

This apple is large, flatish, subcircular. Color yellow. Flesh white, firm, and agreeably acid. Keeps till May. Origin, Ohio, La Fayette county.

142. SHAWMUT.

This apple is small and round. Color yellow. Flesh firm, possessing a lively flavor. Origin near Boston.

143. ORANGE.

Fruit small, round, yellow, and used for cooking. It is described as being a great bearer.

144. NORFOLK.

Fruit small, depressed, yellow, pleasant. Keeps till summer.

145. TABLE GREENING.

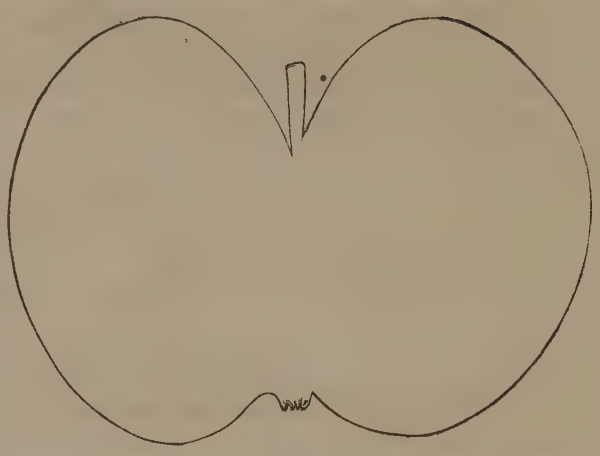
Fruit of the medium size, roundish. Color of a dull green. Flesh juicy and pleasant. Sometimes it keeps well until September of the next year.

146. LEICESTER SWEETING.

Porter's Sweeting.

Fruit rather large, depressed. Color greenish yellow. Flesh tender, rich, excellent. Fine for the dessert, or for a winter baking apple.

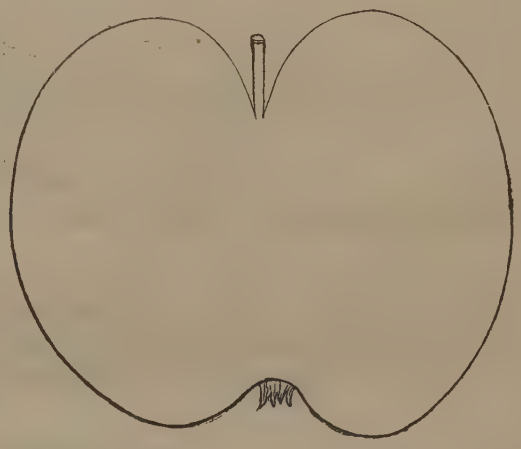
147. HEICKE'S WINTER SWEET, OR CLARK'S SEEDLING. Fig. 60.



Fruit of the medium size; depressed, wide, stem deep, moderately long, but does not project Calyx small, depression rather shallow. Color yellow; blush faint, if any, subject to mouldy blotches. Flesh yellowish, crisp, tender, taste sweet, flavor inferior. Keeps from November to January.

This apple is regarded by some as a seedling, by others as an old fruit, which has been known as a graft for thirty years or more, and known as Heicker's Winter Sweet. Tree is a moderate bearer. It appears, however, that Clark's Seedling keeps until April, and some other differences seem to indicate that the apples differ, although they resemble each other. It is recommended for baking.

148. SEEVER'S SEEDLING, Fig. 61.



Fruit of the medium size, globular, wider than high. Stem slender, deeply inserted, subequaling the base. Calyx rather large, with long segments; depression rather deep, even and regular. Color crimson, elegantly striped upon clear lemon yellow ground; russetty in the stem depression, and bronzed. Flesh yellowish, subacid, juicy, tender, delicate, with the flavor of the pear. Seeds full, roundish; in close chambers, ovate. Autumn.

This apple is well spoken of by the gentlemen composing the Convention of Fruit Growers in Ohio in 1848.

Class III. *Russet or semi-russet.*

Order I. Height and breadth equal or subequal.

A. Ends equal or subequal.

149. AROMATIC RUSSET.

Fruit of the medium size, depressed. Color green, spread with a thin gray russeting; sunny side enlivened with a dull red. Stem very short, deeply inserted. Flesh greenish white, crisp, firm, saccharine, perfumed. Tree productive and hardy. English.

150. KNOBBY RUSSET.

Fruit of the medium size, depressed. Color formed of a mixture of yellow and green. Stem short, deeply inserted. Skin deformed with superficial russetty warts. Flesh yellowish, crisp, rather dry, sweet and high flavored. Tree hardy and productive. Apple keeps till May. English.

151. SIELY'S MIGNOME.

Pride of the Ditches.

Fruit rather small, subcircular. Color gray, netted russet and bright yellow. Stem rather short, slender, exsert; base often fleshy. Flesh greenish yellow, crisp, tender, juicy, saccharine, aromatic, and of fine flavor. Keeps till February. English.

B. Ends unequal.

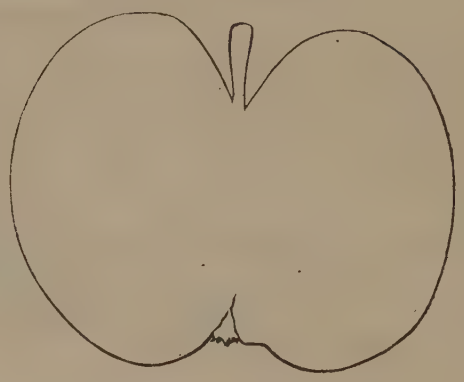
152. ASHMEAD'S KERNEL.

Fruit rather small, elongated, subcircular or subangular; angles extending from the base to the crown. Stem exsert, slender. Color, pale brownish gray russet, spread upon a greenish ground, the exposed side brownish orange. Flesh firm and crisp, juicy, flavor excellent, aromatic. Keeps till May. Tree hardy.

ORDER II. Breadth greater than the length.

A. Ends equal or subequal.

153. POMME GRIS. Fig. 62.



Fruit less than the medium size, symmetrical, circular, depressed. Color, a gray russet, evenly spread over the surface. Stem slender, depression wide, calyx small, basin circular. Flesh very tender and fine grained, rich and high flavored. One of the best of northern apples. Canada.

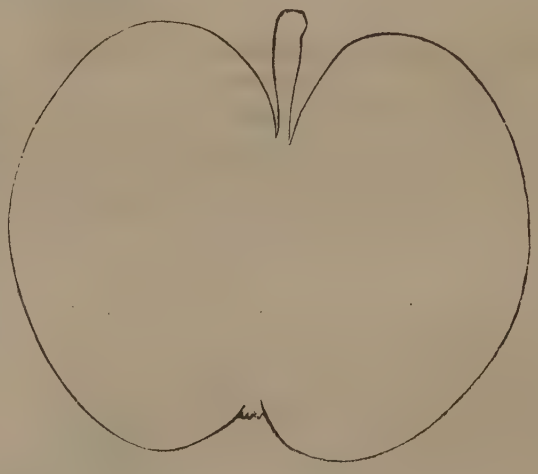
154. FENOUILLET GRISE.

Fruit small, depressed, circular, symmetrical. Color yellowish, russeted. Calyx small. Flesh firm; flavor aromatic.

B. Ends unequal.

155. AMERICAN GOLDEN RUSSET. PLATE 52. Fig. 63.

Bullock's Golden.



Fruit below the medium size, circular, conical. Color light yellow and thin russet. Stem long, slender. Basin small; depression shallow; ribbed. Flesh yellowish white, very fine grained, tender, rich, pleasant, subacid flavor. Early winter.

This apple is one of the most delicate we have in this country.

156. CORNISH AROMATIC. (Hort. Trans. vol. ii. p. 74.)

Fruit large, sides subangular towards the apex. Color on the shaded side russet, thinly spread and brownish; on the sunny side, it is a rich bright red intermixed with russet. Stem short, inserted in a narrow depression. Flesh, firm, juicy, rich, high aromatic flavor. Keeps till February. English.

157. ROSS' NONPAREIL.

Thomp. Lind.

Fruit of the medium size. Color, a mellow yellowish russet, stained faintly with red on the sunny side. Stem long, exsert. Calyx large, depression shallow. Flesh greenish white, tender, with a rich aromatic flavor. Tree productive. Irish.

158. ROYAL RUSSET.

Fruit large, and broad at the base. Color, dull yellowish green, well covered with a thick gray russet. Stem short, deeply inserted in a wide depression. Calyx small, placed in a deep irregular depression. Flesh greenish white, tinged yellow; saccharine, and slightly aromatic.

159. COOPER'S RUSSETING.

Fruit small, elongated; russetty yellow; dry, sweet and rich. Tree large and productive. Valuable for cider.

160. RED RUSSET.

Fruit large, rather depressed; sunny side red. Flesh firm, crisp, and juicy, with a rich flavor. Tree very productive. Originated in New-Hampshire.

161. WIN RUSSET.

Fruit large, rather depressed. Color dark russet. Stem depression shallow. Basin wide and shallow. Flesh fine and tender, pleasant, subacid. Retains its freshness. Keeps till mid summer.

162. REINETTE DE HONGRIE.

Fruit of the middle size; depressed, circular. Color gray russet, thick and rough with warty spots; sunny side, faint orange. Stem short, deeply inserted in a knobby depression. Calyx situated deep in the depression. Flesh greenish white, firm, crisp, saccharine, aromatic.

163. WHEELER'S RUSSET.

Fruit of the medium size, unsymmetrical, depressed. Color pale gray russet. Sunny side a lively brown. Stem short, depression narrow. Flesh greenish white, rather dry; aromatic and saccharine. Tree hardy, bearing abundance of the best of winter russets. English.

164. WINTER RUSSET. (Hort. Trans. vol. iii. p. 454.)

Fruit rather large; costal angles extending to the calyx. Color yellowish green, russetty, and intermixed with white; red on the sunny side; stem short, flesh firm and high flavored in its season. Irish. Early winter.

165. JERSEY CRAB. Plate 39.

Is the name of a Greenbush cider apple. The tree is very vigorous, hardy and productive. The apple is small, and covered with a hazy bloom.

166. GOLDEN HARVEY.

Fruit small, unsymmetrical, russet yellow, with a red cheek. Calyx open, rigid. Flesh yellow, fine, subacid. Tree of a slender growth.

167. OLD NONPAREIL.

Small, excentric, yellowish green, pale russet. Stem slender, calyx small. Flesh rich, acid, sharp. Early winter. English.

168. GOLDEN RUSSET OF NEW-YORK.

Fruit of the medium size, slightly elongated; symmetrical; russeting thick sometimes, then showing the greenish yellow skin. Stem slender. Flesh fine grained, firm, crisp, aromatic. Keeps till spring.

169. ROXBURY RUSSET.

Boston Russet.

Fruit of the medium size, symmetrical, subcircular, ends subequal. Color dull green, becoming in ripening brownish yellow russet, enlivened with a faint blush on the sunny side. Stem exsert, slender; basin circular. Flesh greenish white, subacid, moderately juicy, with a rich flavor. Keeps till June.

The Putnam Russet of Ohio, has been proved after considerable research to be the identical Roxbury Russet, altered somewhat by climate and the rich soil of the western valleys.

165. SAM YOUNG.

Fruit small, symmetrical. Color bright yellow, partly russeted or semi-russet. Flesh greenish, juicy, rich, fine flavor. Early winter.

166. ACKLAM'S RUSSET.

Fruit small, depressed; circular. Color yellowish green russet, covered with a thin gray russet. Stem equaling the base. Calyx sunk in a deep circular depression. Flesh greenish white, firm, crisp, sugary, high vinous flavor. Keeps till February.

167. PINE APPLE RUSSET.

Fruit above the medium size, angular; costal angles obtuse. Stem long, inserted in an irregular depression. Calyx placed in a shallow basin. Flesh pale yellow, crisp, tender, very juicy, saccharine. English.

168. POWELL'S RUSSET.

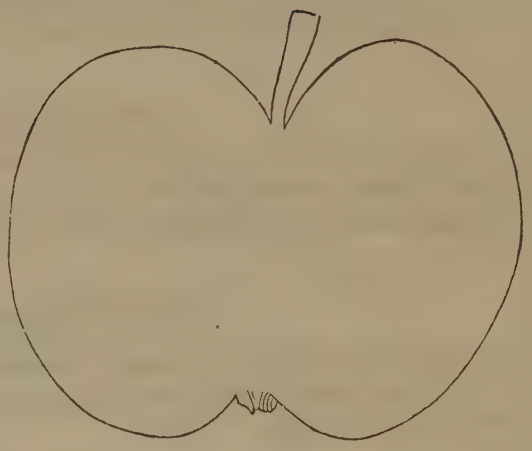
Fruit small, depressed, circular. Color pale yellowish, russet thin around the crown, tinged brown on the shaded side. Flesh firm, clear, yellow, juicy, and tender. English.

169. POMFRET RUSSET. Plate 43.

Fruit nearly of the medium size; subcircular, subsymmetrical. Color, the first year, green, with greenish russet; the second and third years, fawn, or of a soft yellowish tint, and decidedly russet. Stem exsert, calyx small and plaited, both depressions moderate. Flesh greenish or changing like the outside or skin; firm, subacid, agreeable.

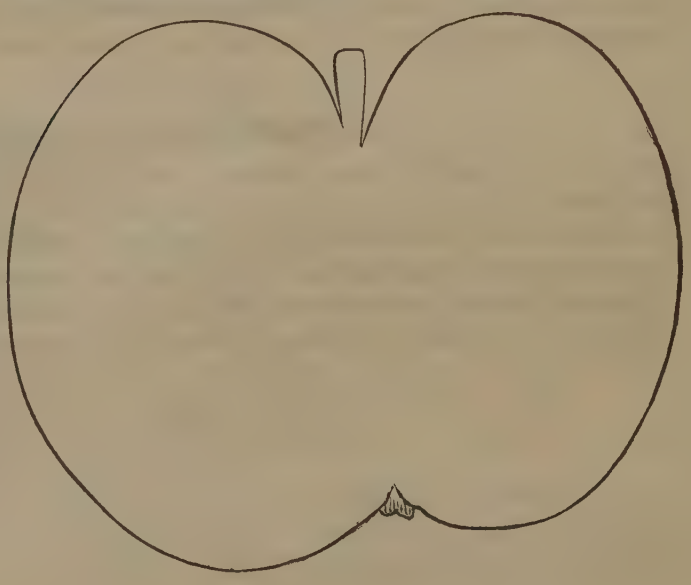
This apple is scarcely subject to rot, keeps at least two years, and for its keeping quality is mainly valuable and interesting. Cultivated for a long time in Pomfret, Connecticut.

170. OLD NONPAREIL. Fig. 64.



Russet in part; greenish, becoming yellowish green; excentric; rather depressed. Calyx rather large; crown with a broad depression. Juicy, crisp, tender; excellent apple, worthy of cultivation; size is economical, and keeps late. The fruit has some resemblance to a greening. Exhibited to the Horticultural Society of Albany county, in 1849.

171. SHIPPEN'S RUSSET. Fig. 65.



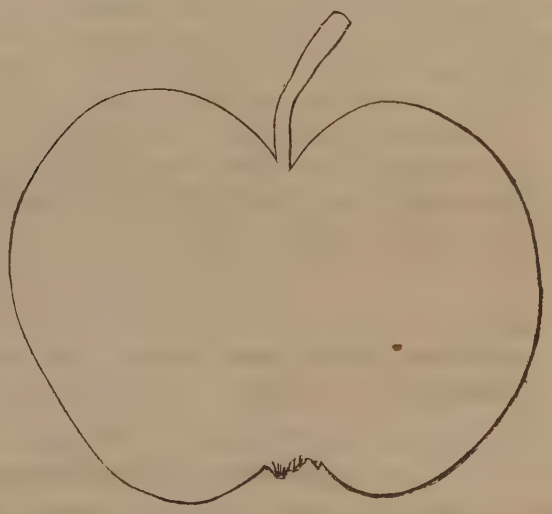
Fruit full medium size, unsymmetrical, depressed, excentric. Color, especially around the crown, orange russet; greenish around the stem. Stem rather short below the base; stout. Calyx large; depression shallow. Flesh white, tart, vinous, and juicy. Apple second rate.

172. ENGLISH RUSSET. Fig. 66.

Fruit of the medium size, or nearly so; circular, subsymmetrical, elongated. Color pale greenish russet, especially about the stem. Stem short, subequaling the base. Closed near the base; depression very smooth. Flesh firm, yellow, crisp, and pleasant; flavor fine.

This apple is unfit for use until February, and may be preserved till July.

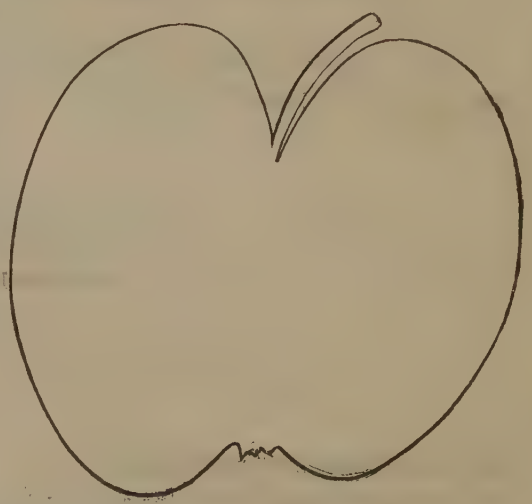
173. BOURASSA. Fig. 67.



Fruit nearly of the medium size; angular or broadly ridged, as in the scolloped or red gilliflower, tapering from the middle. Color russet, with a few deep carmine patches. Skin rough, calyx large; stem long, exsert; depression wide or broad. Flesh rather dry. In flavor, only second rate.

APPENDIX TO APPLES.

174. BENTLEY'S SWEET. Fig. 68.



Fruit of the medium size, or greater; elongated. Length and breadth subequal; unsymmetrical. Stem long, stout, projecting, deeply inserted. Depression deep and capacious, and slightly ridged; calyx large, of a medium depth; sides of the crown unequal. Color red, striped or blotched upon a yellow ground. Core firm; seeds numerous, filling the chambers; large, obovate, accuminate pointed. Flesh yellowish, firm, tender, juicy, flavor pleasant, taste sweet. Winter; keeping till March. This apple is recommended, and is regarded as worthy of Cultivation.

Transactions of the Ohio Fruit Growers, page 30, 1848.

175. ADAM'S PEARMAIN.

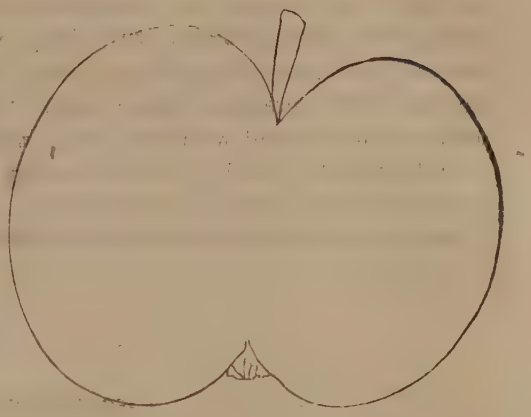
Fruit above the medium size; conical. Color grayish yellow, russetty; sunny side deeper yellow and salmon, faintly striped. Flesh yellowish, fine, crisp. Saccharine, with an aromatic flavor. English.

176. HUBBARD'S PEARMAIN. (Hort. Trans. Lond. vol. iv. p. 68.)

Fruit below the medium size; small, circular. Color yellowish green, with and without russet, and partly striped with pale red on the sunny side. Flesh yellowish, firm, sweet, rich, and perfumed.

177. LAQUIER. Fig. 69

Fruit rather less than the medium size; unsymmetrical. Color yellow, enlivened with crimson in stripes; the yellow often appearing in large roundish spots; the carmine is deepest upon the apex or crown. Stem small, exsert, in a deep excentric depression. Calyx rather large; depression wide, but shallow. Flesh white, tender, juicy, subacid; flavor superior to the Vandervere. Excellent in January.



178. RED CANADA. Plate 42.

Richfield Nonsuch.

Fruit of the medium size; fair; circular; symmetrical; depressed. Color red, but showing the bright yellow ground between the stripes and at the crown; dotted. Stem long, exceeding the base or exsert. Depression wide and even, without plaits. Basin moderate in depth and width. Flesh fine-grained, firm or compact, with a rich subacid flavor, which is of a high grade. It keeps till spring and preserves its flavor.

An apple of a different kind bears the name of Canada red, of which the following is a description:

The foregoing description was drawn up from specimens received from Cleveland, Ohio, which, although differing in form somewhat from the Canada red, yet upon the whole seemed applicable to either the Richfield Nonsuch or Red Canada.

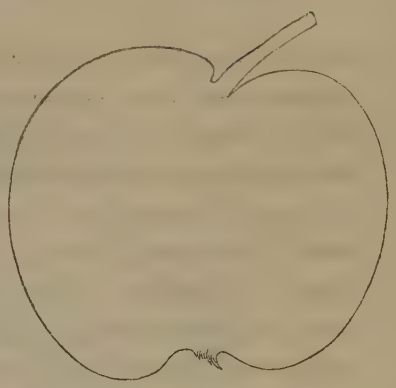
179. HAGLOE CRAB.

Fruit below the medium size; small, unsymmetrical. It is tolerated and used for cider only.

180. HEWES'S VIRGINIA CRAB.

Fruit below the medium size, or small; round. Stem long and thin.

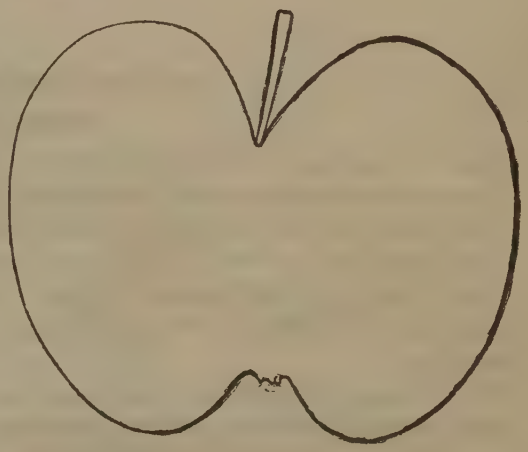
181. CANNON PEARMAIN. Fig. 70.



Fruit below the medium size; unsymmetrical, often subangular, rather globular. Stem long, obliquely inserted, and projecting obliquely from the base. Calyx small; depression small, ridged. Color yellow, and half-spread with brick red, interspersed with large dots. Flesh yellowish, crisp, slightly subacid, rich and good. Keeps till April.

Transactions of the Ohio Convention of Fruit Growers, 1848, p. 31.

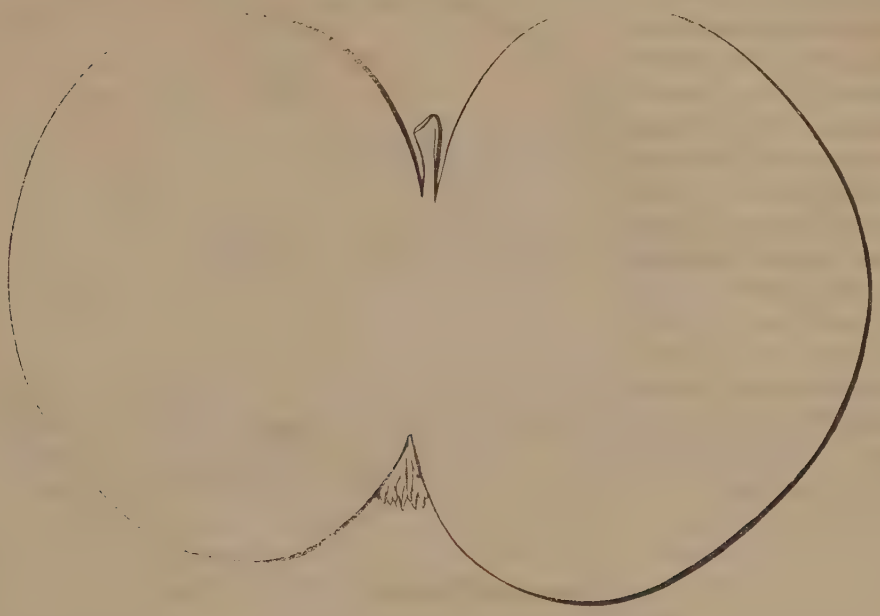
182. ROME BEAUTY. Fig. 71.



Fruit of the medium size or greater; wider than high; depressed. Stem slender, and rather long, deeply implanted. Depression deep and wide. Calyx rather large; depression rather deep. Color carmine, upon a rich yellow ground, the whole surface being nearly all red. Flesh yellowish, crisp, juicy, subacid; flavor pleasant.

It is suggested that it is a seedling from the Seeknofurther. In eating from November to February. Transactions of the Ohio Convention of Fruit Growers, 1848.

183. CABASHIE, OR CABASHEE. Fig. 72.



This apple is more remarkable for its size than for its valuable qualities. It is not, however, an inferior apple. For cooking it is certainly esteemed, as it has a pleasant and agreeable taste. It is, however, too large. Yet in an orchard where there is room, it may be cultivated, as it illustrates the remarkable property of the apple to form varieties.

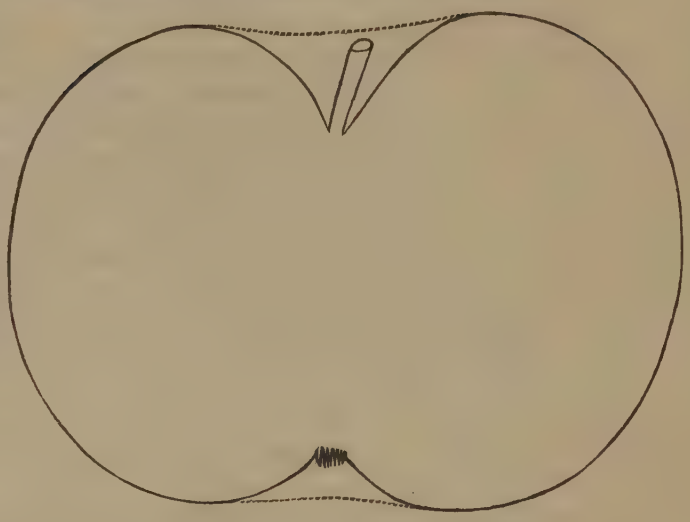
184. COLLET.

Fruit of the medium size, elongated, circular, symmetrical. Color carmine red, lighter around the crown, and spotted. Stem short, thick; depression russeted. Calyx open, large. Flesh yellowish; flavor rich and sprightly.

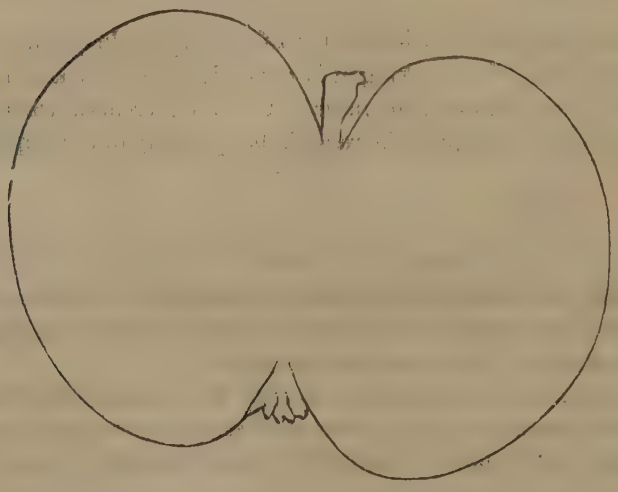
This apple was obtained in Montgomery county, Md., and cut the 9th of May, and had been exposed for four weeks upon the table, and subjected to many changes of temperature; yet was juicy, with a flavor as sprightly as a Spitzenburgh, which it resembles.

185. COOPER APPLE. Fig. 73.

Fruit above the medium size, depressed, unsymmetrical. Stem short and slender, implanted in a deep depression. Calyx closed, and surrounded by a wide, flattened crown. Color greenish yellow, and striped and blotched with pale red; flesh yellowish, crisp, juicy and pleasant; flavor agreeable, but not high; texture coarseish. Ripe in September, in southern Ohio.



186. GRAVENSTEIN. Fig. 74.



The figure of the Gravenstein was accidentally omitted at its proper place, and is introduced here for reference. See page 32.

CHAPTER III.

GENERAL REMARKS ON PEARS.

The excellence of this fruit is universally acknowledged, and were it not for the difficulty of cultivating it, few individuals would deprive themselves of the luxury it furnishes. But in consequence of the diseases to which the tree is subject, and the ill success which has attended many in the attempts to cultivate it, it is, to say the least, far less in use than it otherwise would be. The greatest evil which the pear tree has to encounter, is the fire-blight. What this disease is, or what is its essential nature, has never been told. If vegetables can be supposed capable of inheriting the diseases of the higher orders of beings, if it could be proved that high vital action, as in the case of animals, could end in mortification or gangrene, then we might be justified in pronouncing the fire-blight a gangrene, a tree mortification. Whether such a view can be maintained or not, may be regarded as questionable; still, the phenomena of the disease, from beginning to end, resemble what takes place in the mortification of an arm or leg. We have not, however, the means for determining the nature or character of the circulating fluids, or the condition they may be in at the time of the onset of the disease. We have, however, some facts which throw a feeble light upon the question. Atmospherical agents seem to play a part in its development. For instance: that peculiar state of the weather, which is called sultry, when it is succeeded by a scorching sun, is quite influential in the production of blight; or the relations of the supposed cause stand to the blight somewhat as antecedents and consequents. I made some observations on this disease in 1847, and as I have not seen cause to change my opinion, I propose to repeat them in part in this place.* It is proper, in the first place, that the term blight should be restricted to one disease. For instance: the Scolytus pyri, of Peck, girdles a limb and it dies, and when dead looks as if it had perished from the real blight; but this is no blight at all, and the remedy which is applied with success in one case, is entirely inefficient in the other. The effect of remedies is one of the best tests in deciding

* American Quarterly Journal of Agriculture and Science, July No. for 1847, p. 5. Aug. No. for Sept. p. 179.

on the nature or identity of two diseases. The excision of the dead or dying limb containing the little depredator, and burning it, assuredly puts an immediate stop to the progress of this kind of blight, as it has been termed, while the knife very rarely has the same salutary influence in the true blight. The term *blight*, is also applied to a diseased condition of the plum tree, and which is also the effect of an insect in its larva or grub state, nestling in the branches and producing an exudation of gum in part, and a fungous growth of wood, which turns black the second year after the injury. This too is cured by excision; though it is often left until so many branches are affected that the tree must suffer great mutilation in order to remove all the affected branches. Yet it is the only way to treat it. I may add to this also, the attacks of the leaf-rollers. They destroy the young leaves, and may be the young branches too, which finally turn brown or black.

The true blight, however, cannot be traced to injuries by insects. Or at least we may say that there is a disease as independent of these as that of the yellows in peach trees.

We would confine the term *blight* to that disease which seems to stand as a consequent to certain atmospheric conditions.

To atmospheric causes we may superadd a rapid growth by a superabundance of sap or of circulating fluids. I think this view is sustained by the fact that limbs of a rapid growth or young thrifty growing trees have generally suffered more than those of a slow growth, and whose texture is apparently more firm and compact. It is true, however, that the disease of fruit trees, which is usually known as the blight, by no means stands in striking contrast with the potato disease. In fact many of the phenomena of each are quite similar, both in appearance and in their ultimate results.

The potato disease commences in the leaf and stem,* beginning with a drying of the former upon its edges, and extending rapidly through the whole texture. The same effects follow with all the leaves in quick succession, and sometimes, when the cause acts intensely, the stems and leaves become perfectly brown and crisp in a few hours. The same changes take place in the blight of fruit trees; first a leaf becomes brown and crisp, or several of them are attacked simultaneously, and the first thing which attracts our notice is the perfect death of a small branch which hangs down in the midst of a perfectly healthy vegetation.

The disease may commence in the middle of a large limb and extend both ways, and it often happens that the termination of the branch, the newly formed wood, is the last to die. If a limb partially destroyed by the blight is closely inspected, the following phenomena may be usually observed. Patches of brownish bark on the sides of the limb. These do not extend entirely around it, and they may appear at irregular distances, and are separated from each other by living bark, but they soon coalesce and extend around the limb, as well as in the direction of the base and apex. But accompanying the death of the bark of the limb, there is also the death of the apex of the expanding leaf buds. If these are

* Subsequent examinations of diseased potatoes, seem rather to sustain the view that the disease manifests itself in the stem near the tuber, where it becomes dry and finally soft, even while the leaves are fresh and green.

closely examined, they are frequently found softened and of a blackish brown color, and the attachment of the surrounding leaves will begin to be loosened, the whole circulation being cut off or destroyed.

If the whole limb is observed, then, in this disease, while it is progressing, a close inspection reveals patches of a brownish or leaden hue, and a slightly wrinkled state of the cuticle; the leaves brown in spots, others totally brown and dry, and ready to fall off. If now we make an incision so as merely to raise up the cuticle, the cellular tissue below is perfectly brown, or blackish brown; the junction of the bark with the wood is also discolored, and the wood beneath soon becomes dry and hard, and perfectly impervious to the fluids of the limb.

If the above description is true, our intelligent readers will scarcely fail to recognize in the symptoms and progress of the disease a true vegetable mortification, beginning with a death of the outside, which proceeds from a small surface upwards and downwards, and also inwards. The circulation in the centre of the limb proceeds languidly for some time, so far at least as to furnish nutriment to the extremity, while all below is dead and destroyed. So, too, as in mortification of the limbs of animals, a line of separation takes place between the dead and the living parts, beyond which the disease does not extend.

In accordance, then, with the above remarks, we have in many instances of post mortem examinations, pronounced a verdict of *death from mortification;* at the same time we have been constrained to add that in view of the primary cause we were in the dark.

There is nothing which conflicts, so far as we know, with the view that all living structures may be subject to death from mortification or gangrene. In animal structures gangrene results from a variety of causes, and is always to be set down as an effect. In aged persons the toes mortify, or the extreme parts which do not seem to be duly supported by the fluids. In cases of high inflammation the parts sometimes die or mortify, and are finally thrown off if the part is not a vital one. It can hardly be supposed, however, that vegetables are liable to attacks of inflammation; we may, it is true, suppose that under a hot sun the fluids and the solids may be acted upon in a manner analogous to that which results in inflammation in animals—still we can by no means feel satisfied that is truly the case.

The gangrene or mortification which occurs in trees, seems often to result from want of vigor or strength in the tissues, though by no means are we warranted in drawing the conclusion that it is always so. When, however, we see a tree with rather delicate leaves, and with long, straggling, pendant branches, losing its leaves and branches in succession, we may suspect that there is a want of ability to supply the amount of sap to preserve the vital principle, and especially where we find that heading in the branches results in stopping the progress of the decay, by giving more energy to the remaining parts.

The death of vegetables from mortification described above, differs materially from death by the girdling of the larvæ of insects. In this case there is not that peculiar unhealthy appearance of the tissue of the parts beneath the cuticle, and generally the whole limb dies at once down to the place where the insect has formed its trench. The oak, and in

truth many trees, are destroyed by the operations of a girdler. This is a cause which is easily ascertained, the whole effects of which resemble precisely the operations we often perform upon trees for the purpose of destroying them; and we may add, that the phenomena attending the death of the tree or limb is precisely the same. The source of nutriment in both cases is cut off, and the limb or tree dies simply of starvation. There is in neither case an infused poison, but merely a destruction in the continuity of the parts which transmit the sap from the roots to the branches. In this case we are able to trace the death to a satisfactory cause, and our verdict on a post mortem examination must be, death from girdling.

The late Prof. Peck, as is well known, discovered the cause of one species of blight, in the insect called the Scolytus pyri, which eats around the branch beneath the bark.

This kind of blight must necessarily be distinguished from the blight which we have described, and which we consider a true vegetable gangrene. The remedy may be the same, viz., extirpation. In the one case extirpation is performed for the purpose of destroying the destroyer; in the other, it would seem for the purpose of preventing the mingling of tainted fluids with those which are healthy, and by which it is to be feared the disease may be extended to the whole system. In support of this view of the matter, it may be observed that it is an established fact that the contact of diseased parts with sound ones, or the mingling of diseased fluids with the healthy, is invariably injurious; and that under such circumstances the disease propagates itself in a manner which may be likened to the effects of leaven. This, it is true, is one of the oldest ideas of cause in accounting for diseased or unhealthy action, though of late it has been brought before the public in a dress somewhat new. As we are now speaking of the cause of blight, it is but right that we should refer to a cause which has been assigned by a distinguished writer upon horticulture. The writer referred to maintains that it is caused by sap which has frozen during the preceding winter.

There are many objections to this as a cause of the blight here described.

1. If the sap is frozen, and is thereby changed in its properties, it can hardly be maintained that it is capable of performing the part of a nutritious fluid, and possess the required properties which shall fit it for the development of leaves. It is but rational to infer that sap, when changed essentially by any cause, should act in the first period of its circulation in its usual way, and then subsequently, after having performed the exact purpose of healthy sap, at last can cause the death of a part which it had brought into life and existence. Besides, it is no where shown that frozen limbs always result in their destruction, or or in the destruction of the sap. Repeated freezing and thawing will undoubtedly destroy the vegetable organs, but in these instances the effect is immediate, and the limb or tree never puts forth its leaves at all. In the county of St. Lawrence, and in other parts of the State, where frost destroys a tree or a part of it, there is an entire end of it. It never exhibits a vigorous life, it never puts forth strong and healthy leaves and blossoms, but it is actually a dead tree, or a dead part, when the cause has thus acted upon it.

2. It is agreeable to all that we know of the effects of freezing that the new wood, or the latest growth, should suffer most. Thus the young of peach trees in some locations is often destroyed. The ends of limbs are dead. But not so in blight. The disease rarely begins with the extremity, but usually in the middle of a branch, as has been already described, and this not until after the limb has been covered with a vigorous growth of leaves and new wood, or an extension of its branches has taken place. In such a case it can hardly be supposed that it is really the same sap which has been supposed to have been frozen in the opening of spring, or during the winter. This sap has already been expended in the growth of new parts, and a new formed sap supplies the plant with this circulating fluid.

3. It seems more consonant with facts, to infer that when a vegetable is destroyed, immediately or ultimately, by frost, that death takes place by injury which the solids sustain, rather than by the injury of the fluids. The change in this case in the fluids is an effect, and not a cause—the solids themselves being the organs by which healthy fluids are generated, though it still remains true that when the fluids are imperfectly formed, or are changed in their essential properties, that death or injury to the structure must necessarily follow, notwithstanding the solids are in a healthy state. The foregoing considerations are sufficient with us for the rejection of the theory which maintains that frozen sap is proximately the cause of blight in fruit trees. To these we might still add other considerations which go to disprove it. So we dissent, also, from the views of the author of this theory in regard to the proposed remedy, viz., a coating of whitewash. This seems to have been proposed from a misapprehension of the nature of the coating itself; for, in fact, so far as the coating operates at all, it must promote rather than retard the freezing of the sap. An earthy material, of the nature of whitewash, is a better conductor of heat than the porous and partially dry cuticle itself. The remedy which has been proposed for the treatment of blight, is simple, but strikes not at the root of the evil. The limb, when found affected, may be removed; it is no longer a living part of the vegetable system. A close inspection of the bark, with incisions of the cuticle, will show the extent of the disease, and all that is diseased may be removed at once. It does not follow, however, that because a limb is not removed the whole tree will certainly die, for instances do occur where the tree lives on with its dead branches remaining. The knife, however, can be freely applied, for the limb is irreparably gone, and the fear that contaminated fluids may occur, by which the disease is extended, may stimulate us to the excision of the member.

The period when the blight begins is about the middle of June, after there has been a considerable part of the growth of wood for the year. It must often seem that temperature has something to do with the disease, and still the only fact which favors this view of the subject, is time, for it is not to be supposed that a certain degree of heat will cause the disease, and if it has any thing to do with it, it is only one of the conditions. Without recurring to theoretical grounds, or those which stand upon the known properties of matter, as it regards the conductibility of caloric, we believe experience has fully disproved the theory.

The blight is evidently making sad work in many parts of New-York. Both apple and pear trees are injured by this destroyer. We have in one instance observed from fifteen to twenty recently dead limbs upon a single tree. What is quite remarkable and beyond comprehension, is the fact that a single tree is sadly affected, while those around and equally exposed to the operation of general causes, remained untouched.

It seems from these facts, that in the vegetable as in the animal kingdom, death strikes a blow where it is the least expected, and in a manner or by an instrumentality which has hitherto eluded our search. We deem it, in the present state of knowledge, to be entirely unknown, so far as cause is concerned. The fact of the death and the phenomena accompanying it are plain enough, but by what agency the blow is struck, is enveloped in darkness, unless we regard the atmospheric changes as causes.

A profound ignorance of the cause of the blight does not stand alone. If the cholera in the human species is still wrapped in as dark a mystery as ever, it is nothing strange that a disease should attack the vegetable whose cause also should hide itself in the profound. We know far less* of vegetable than of the animal structure, and less of the mode by which the imponderables act. It is not strange, therefore, that we often inquire unsuccessfully after causes, and that we are so frequently obliged to stop our inquiries at negative results.

This is a theme which may be made as prolific in opinion and theories as the potato disease. Its cause is just as inscrutable. So in regard to remedies; we know of no course of treatment which can prevent its occurrence, or stay its progress. Observation and experience, however, in some instances, have determined one thing: that it is better to leave the dead branch upon the tree, than to attempt to arrest its progress by a free removal of its branches. Experience proves, too, that no evil is to be apprehended from a poisoned sap by which the disease may be extended. We take great pleasure in alluding to the experience of E. P. Prentice, Esq., whose fine garden and orchard has suffered excessively by the blight. Three years since his gardener, as we are informed, was directed to make a regular business of removing every limb which was attacked, below all appearance of disease. This was persevered in. In 1847, while the disease has been equally severe, the dead limbs have been suffered to remain, and it is extremely interesting to observe some of the results. So far from proving the death of the individual from what are usually called poisoned branches, there is an unusual vigor in the parts of the branches which remain. The effect is much like that which follows from shortening the branches by the knife. The limbs grow rapidly, and the leaves are of deeper green; and they continue growing to a period in the season when it is unusual for wood to be formed. What, however, is the most remarkable result or phenomenon, is the vigor of the end of a limb beyond the apparently dead and dry

*It should be stated, however, that microscopical observations prove that the structure of vegetables and animals scarcely differ. The organs which compose the individual are formed upon a uniform basis, the cellular tissue.

Note. It is also advisable to employ lime freely by spading it in the soil, and giving occasional dressings of the oxide of iron obtained from the forges of smiths. I would discard the use of organic manures which favor a rapid growth or swelling out of the cellular system, without imparting sufficient vigor to resist those causes which are active in developing this disease. These considerations are offered on physiological grounds, rather than on personal experience. Still I believe they will be found useful, even if not perfect preventives of this mysterious malady.

portion of it. The limb is constricted, and is nearly one quarter smaller than the adjacent parts above or below. This constricted portion appears so perfectly dead and dry, that it seems impossible for the sap to pass through it and reach the vigorous and living portion beyond; which is not only bearing large leaves but also fruit, which is also equally as large and promising as that upon any of the unaffected limbs.

The effect of the disease as exhibited in very numerous instances, is much the same as that which follows from ringing a branch; a process by which the circulation, as is maintained, is interrupted. Its descent to the root is at least partially prevented, by which there is an accumulation at all times of nutritious fluids in the limb above the removed or injured bark and wood. The constriction where the disease is seated is mechanically arrested, however, with the ascent and descent of the sap; for here it is evident, by the dry state of this portion of the limb, that its vessels are nearly impervious; and after a short time they become entirely so—the disease passing from outside to inside, and not in the opposite direction. The circulation, therefore, is sustained by the interior. It would seem from an inspection of the dying branches that it is almost impossible, in many instances, for the sap to pass along the limb; still, there is no doubt that this it does so long as a green leaf appears.

The following cuts exhibit the facts we have stated; and it may, if followed out, throw new light upon the circulation of sap, and of the nutrition of vegetables.

Fig. 1.

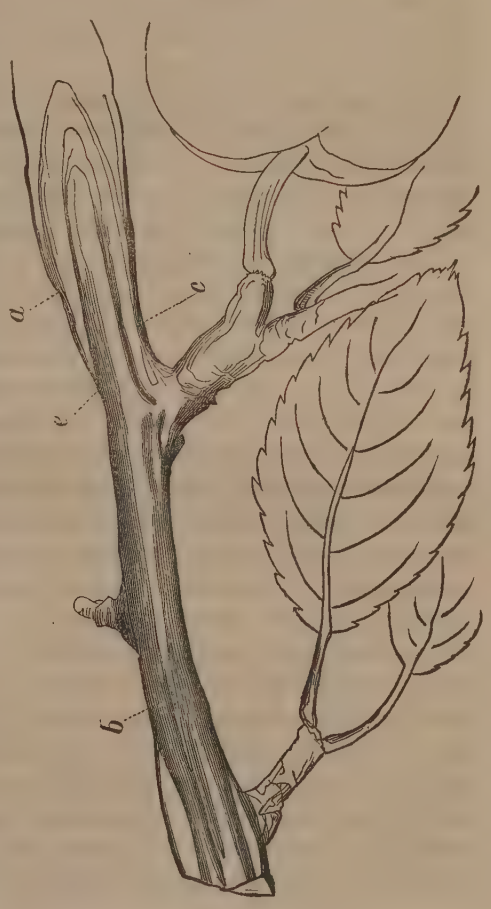


Fig. 1. Part of a blighted branch of an apple tree, which was taken from the garden of E. P. Prentice, Esq., of Albany.

a, Dead bark and wood; *b*, living bark and newly formed wood; *c*, constricted portion of the stem, and dead upon the outside; *e*, interior of the stem, showing signs of life; *f*, living and luxuriant growth of part of the branch.

In this example there is quite a thickened state of the branch at *a*, which in the specimen, is strongly contrasted with the part beyond the dead portion; as it is about $\frac{1}{4}$ thicker by the formation of new wood since it was attacked by the blight. Most of the new growth has taken place since the time when a branch usually acquires the length of stem for the season. In the bark, or immediately

beneath it, there is often an accumulation of sap in the swollen vessels in a quantity sufficient to flow out in a rapid stream for a moment after it is wounded. This blighted part bears large and healthy fruit, as represented in the cut.

Fig 2.

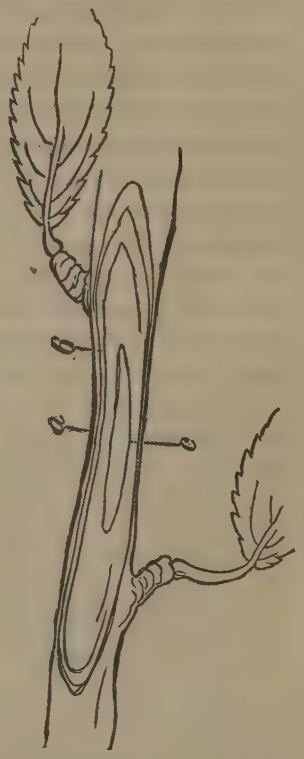


Fig. 2. A stem two years old, from an apple tree in Mr. Prentice's garden.

a, Dead band, forming a constriction of the branch; *b*, a layer of new bark formed beneath the old bark; *c*, living interior the wood of last year, through which the life of the stem beyond the constricted portion is preserved.

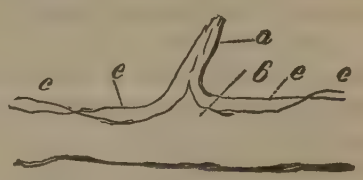
Fig. 3. A short piece of a branch, showing an area of dead or blighted portion, in the centre of which stands a dead stem.

a, Dead stem, dry and brittle; *b*, living interior, with a projecting point extending up to the centre of the dead stem; *c c*, dead bark extending around the dead stem; *e e*, living bark.

This dead portion is a patch about an inch and a half in diameter, measured along the stem. It does not, however, embrace the whole of it or extend entirely around it; and it is not unusual for the blight to affect an area in which there is a small branch in its centre, or nearly so.

Close observation upon the state of the weather, the character of the winds, etc., seems to be highly important. We ought to remark that the disease appeared to have ceased its ravages for three or four weeks preceding the first of August. Our heaviest rain for the season occurred on the 30th of July. The heat of the three days after this heavy rain, had been rather oppressive; and now, the fourth day, the leaves of the branches, which are remarkably vigorous, begin to curl and lose their bright green, as if another attack had commenced. A few days will determine the fact. We may remark, too, that the beautiful and vigorous pines of Mount Hope, the residence of Mr. Prentice, exhibit the same phenomena as the fruit trees. The terminal branches in these pines, is the seat of the disease. It does not seem to extend to the large branches. One fact in regard to Mr. Prentice's garden and orchard, ought not to be forgotten, viz: that he uses much stimulating, azotized manure, from his establishments. It is not stated, however, as proving that high living, in the case of vegetables, predisposes to the blight; and yet, it appears that some of the worst cases of the potato disease have happened when they have been highly manured. The effect of rich manures, especially those abounding in organic matter,

Fig. 3.



deserves consideration. Comparative observations are wanted to make out the case for us; but certainly there is some proof derived from the analogy of things, that vegetables may be so far over-stimulated by certain manures, as to render them more susceptible to the causes of disease. Analogy, however, must not lead us astray. A vegetable has but few, if any, of the properties of the animal; and we may not certainly conclude, that because a good liver becomes fat and subject to gout and dropsy, that a tree, from an abundance of food, will become corpulent and liable to perish from a surplus of food.

Another important rule of practice which seems to be established, is that it is better to wait until the termination of the disease, before the dead parts are removed. The rule will enable us to save much of the tree which would be sacrificed if the limbs are removed at random; and since experience proves that there is no danger of an extension of disease from their remaining, the propriety of this course need not be urged.

There is still another species of blight which attacks fruit trees. It might be called the leaf blight, inasmuch as it first begins in the leaf. The branch does not necessarily perish; frequently it does. Most of the leaves curl, dry up and fall off; if they all fall off, the limb necessarily dies. This affection differs from the pear blight in this: the limb maintains its color, except that it is dry. There is no appearance of gangrene; and if one or two leaves are saved the limb will not die. In the pear blight, which affects the limb so remarkably, gangrenous patches are common, and the leaf seems to die from an obstruction of the flow of sap. In the leaf blight, on the contrary, the death of the leaf is the cause of the death of the branch, by checking the flow of the sap into the branch. The elm is more subject to this disease than any of our forest trees, except the buttonwood. The disease is confined to those, we believe, which are cultivated; at least, they seem to suffer more than those which have not been transplanted.

CLASSIFICATION OF PEARS.

It is a matter of considerable importance to discover a classification of this fruit, which shall furnish constant and distinctive marks. The most superficial observer will not fail in recognizing differences between many varieties; there are others, however, where the resemblances are so close that the practical eye fails to discover those differences which relieve from doubt and uncertainty. Characters in natural history have degrees of value. Color, in some instances, is of the greatest importance; in others, of no consequence at all; in others still, it is of more or less value, being itself graduated in this respect by its constancy. In apples, whose colors are variegated, there seems to be a greater constancy than in pears. It perhaps arises from a greater variety in the colors of apples, and in their remarkable brightness and depth; but in pears colorings are mellowed off in a softness which is rarely seen in apples. It is difficult to express in terms, the real tint which constitutes the main differences in two or more allied varieties. Color, therefore, in pears, though important, is less useful as a distinctive mark, than in apples.

Another important character is obtained by a comparison of the proportion of parts.

Form is another character which retains sufficient constancy to be employed as a characteristic. From the foregoing considerations, and others which might be stated were it necessary, I propose to make a new classification of varieties of pears, otherwise it will be impossible to describe them so as to enable one to recognize them. The season of ripening, as it proves a useful fact, will be employed in forming the first division; at the same time it is evident that in natural history it is not a basis of any importance. As we find this fruit ripening in summer, autumn, and winter, we have the three divisions, Summer, Autumn, and Winter pears. The disadvantage of this division is, that we have many betweens, which it is difficult to locate. Still there are so many advantages in retaining this primary division, that I would by no means reject it.

DESCRIPTION OF PEARS.

PRIMARY DIVISIONS, SUMMER, AUTUMN, AND WINTER.

I. CLASS. *Height and breadth equal or subequal.*

II. CLASS. *Height greater than the breadth.*

I. ORDER. Base acute or subacute.

II. ORDER. Base rather broad, with an indentation

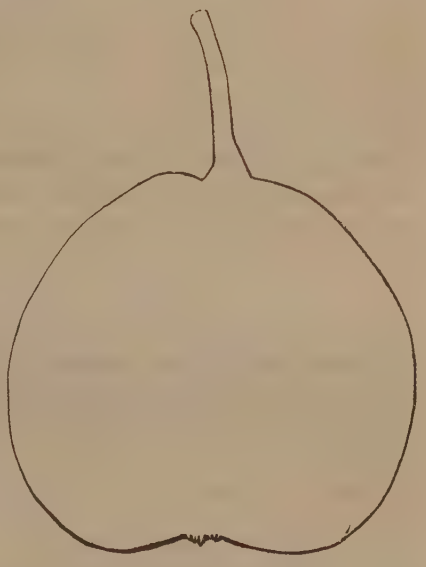
SUMMER PEARS.

CLASS I. *Height and breadth equal or subequal.*

ORDER I. Base acute or subacute.

4. BLOODGOOD. PLATE 13, *d*.

Fig. 1.



This pear attains a medium size; its form is turbinate, having rather a wide base; its widest part is below the middle. Base subacute, contracting rapidly to a long, stout stem. Calyx depression shallow. Color yellow, partially russeted; flesh yellowish white, buttery and melting, with a fine aromatic flavor. Ripens about the second week in August. It should be house-ripened.

"This pear is liable to some defects, as decay at the core and insipidity, on certain soils."
Thomas.

5. AMIE JOANNET.

Early Sugar, St. John's Pear, Joannette.

This pear is smaller than the medium size, turbinate in form, with a short neck. Color light green, changing to a yellow, and in the sun, of a light brown. Skin marked with red dots. Stem long, and fleshy at its insertion. Calyx large, depression obsolete. Flesh, from being juicy, becomes dry, sweet. Flavor below the standard. The first to ripen.

6. SUMMER DOYENNÉ.

Fruit small, low turbinate, or wide through the middle, obtuse. Color a fine yellow, ornamented with a fine red cheek, deepened at the base. Stem long. Calyx wide, very shallow. Flesh melting and juicy, sweet. Skin thin. Core small. Seeds small, white.

A new pear. See J. J. Thomas, page 216, American Fruit Culturist.

7. WILLIAMS' EARLY.

Fruit rather small, round turbinate, or very obtuse, tapering rapidly from the middle, symmetrical. Color bright yellow, ornamented with rich scarlet dots on the sunny side. Stem long, central, and straight. Calyx short; depression shallow and wide, and slightly plaited. Flesh white, juicy, with a rich, musky flavor. Late summer or early autumn.

8. FRENCH JARGONELLE.

Summer Beauty.

Form regular, pyriform, and attaining the medium size. Color light green, but in ripening changing to a lemon yellow, ornamented with a bright red cheek. Stem rather long, slender. Calyx small, and rather projecting, or scarcely sunk. Flesh white and coarse, sweet. Rots at the core, and is regarded only as third-rate.

9. OTT.

Fruit rather small, round turbinate. Color greenish yellow, semi-russet; sometimes the cheek is mottled in red. Stem rather long and slender. Calyx rather short, depression wide and shallow. Flesh rich, perfumed like the Seckel. Ripens by the middle of August.

Originated in Pennsylvania.

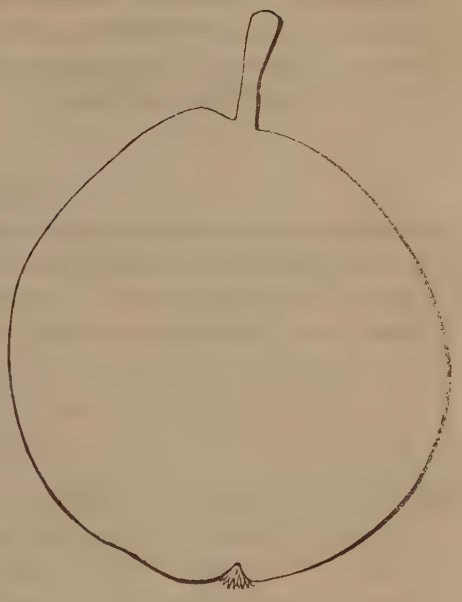
10. BRANDYWINE.

Fruit of the medium size; form varying, as to the width of the crown. Skin smooth, and of a dull yellowish green, with the crown russeted. Stem variable, but rather short, with a fleshy base. Flesh white, juicy and melting; flavor fine.

Tree vigorous and productive. Originated in Delaware county. New. *J. J. Thomas.*

ORDER II. Base indented.

11. SUMMER FRANKREAL. Fig. 6.



Fruit of the medium size, wide turbinate, or shortened, tapering abruptly to a narrow base, with a narrow depression, from which a rather short, stout, erect stem projects. Color green, but changing to yellowish green, and may be tinted brownish on the sunny side. Calyx closed, depressed, furrowed. Flesh white, fine-grained, rich and excellent. Late summer or early autumn.

12. DEARBORN'S SEEDLING. (*Manning, Thomp.*)

Fruit rather below the medium size, round turbinate, regular; depression shallow, having a long, slightly curved stem; shoulders of the depression rounded, or obtuse. Skin smooth. Color clear, bright yellow. Calyx spreading wide; depression shallow. Flesh white, juicy, sweet and sprightly. Ripens about the middle of August. First-rate.

13. OSBAND'S SUMMER.

It attains the medium size, though often smaller; form regular, turbinate, but with convex sides, and an obtuse, indented base, bearing a short, stiff stem, only slightly inclined. Color greenish yellow, and finally yellow, cheek browned, and may be russeted. Calyx rather large; basin wide and shallow, plaited. Flesh white, granular, sweet, fine flavor, but transient. Ripens early in August.

Shoots yellowish olive, and thick. Originated in New-York, in Wayne county.

14. MADELEINE.

Fruit of the medium size, or less, short pyriform, with rather straight sides, which taper from below the middle to narrow base, obscurely indented. Stem central, long and slender. Color pale yellowish green, cheek rarely tinted brown. Calyx small; depression very shallow. Flesh very juicy and melting, acid and delicate. Ripens early, which is completed in the house.

15. AMBROSIA.

Fruit of the medium size, round turbinate, sides rounded to the base; indentation unsymmetrical, higher on one side. Skin smooth, marked with gray specks. Color greenish yellow, and may be russeted. Stem very stout, standing obliquely, nearly straight. Calyx closed; depression shallow, but broad. Flesh buttery, melts upon the palate, sweet, rich and perfumed. Ripens the last of August.

16. JULIENNE. (*Coxe, Manning.*)

Pear attains the common size, symmetrical, short pyriform; indentation shallow. Stem of a medium length, rather thick, slightly curved. Skin smooth and fair. Color bright yellow. Calyx small, closed; depression shallow, and a little plaited. Flesh white, sweet, moderately juicy. Ripens in August.

It is a handsome fruit. Tree productive and profitable, but liable to variation, from the character of the soil.

17. MUSCADINE.

Fruit of the medium size, roundish, by the convexity of its sides and thickness of its base, which is moderately indented; the indentation bordered by wide, rounded shoulders, inclosing a thick, stout stem, moderately long and slightly curved; very wide at the crown; depression wide and shallow, with a large, open calyx. Color pale yellowish green. Skin roughish, thickly sprinkled with brown-dots. Flesh white, buttery, melting upon the palate, exhaling a musky, agreeable flavor. Ripens the last of August.

This variety is regarded by Downing as first-rate. Supposed to be a native of Orange county, New-York. The tree bears heavy crops, and when house-ripened, is equal in quality to any pear of its season.

18. SUMMER ROSE.

The size of this pear is rather less than the preceding, is more rounded, its sides more convex, and terminate with a rapid taper; the indentation is quite small. Stem long, slender, curved more towards its extremity. Crown wide, depression very shallow. Color pale yellow, dotted with russet in the shade; cheek red russet, with crown-dots. Flesh white, juicy, sugary, below first-rate. Last of August.

19. MANNING'S ELIZABETH.

This pear is smaller than common, obovate. Skin smooth, bright yellow. Stem rather short; indentation shallow. Flesh white, juicy, melting, sweet and perfumed. Last of August or first of September.

20. KINGESSING.

Leech's Kingessing.

This pear is large, and rather thick and clumsy; base obtuse, with a shallow indentation, inclosing a short, slender, curved stem, thickest at the base. Color green, variegated with dark patches. Calyx small; depression quite shallow. Flesh buttery, delicate and rich. Ripens the last of August.

It is supposed to have originated in Philadelphia, Pennsylvania.

21. MOYAMENSING.

Smith's Moyamensing.

This pear is scarcely less than the preceding, but is subject to a variation in this respect; sometimes it is quite large, unsymmetrical, or oblique; base oblique, with an obsolete indentation, bearing a short, thick, erect and fleshy stem. Color lemon yellow, skin may be russeted; basin plaited, shallow and small. If eaten at the right hour, it is nearly first-rate. Origin, Philadelphia.

The stem of both the preceding pears is described as short, although it may be an inch long.

Class II. *Length greater than the breadth.*

Order I. Base acute or subacute.

22. TYSON.

Fruit of the medium size, long turbinate, narrowing gradually to a thick, straight and erect stem; base acute. Calyx set in a shallow depression. Color bright yellow, cheek ornamented with brown, and tinted with russet. Flesh fine-grained, the pear melts upon the palate, is sweet, aromatic, and slightly perfumed. Excellent. Ripens the last of August.

23. ROSTIEZER.

Fruit rather small, pyriform, symmetrical. Color green, with a brownish tint, and dark, dull brown cheek; skin dotted, and marked with traces of russet. Stem long, curved. Calyx set in a shallow depression. Flesh juicy, melting and sweet, to which is added a fine perfume. Excellent. Ripens late in summer.

24. ENGLISH JARGONELLE.

Jargonelle.

Fruit above the medium size or less, long pyriform, tapering unequally to the stem. Stem long, slightly curved, and set on one side. Color greenish yellow; skin smooth, and brown upon the sunny side. Calyx open and large; depression shallow. Flesh yellowish white, fine-grained, juicy, with a luxurious flavor. Ripens in almost the first of August.

The tree is vigorous, but the branches are unsymmetrical or straggling. This pear is not regarded by Downing as equal to Dearborn's Seedling, or Bloodgood. Yet, being productive, and widely known, is more abundant in market than the better sorts of early pears.

Order II. Base indented.

25. BARTLETT. Plate 12, fig. 2.

Williams' Bonchretien.

This pear is quite large, elongated, its surface is wavy. Color yellow, cheek browned in the sun, or tinted with a blush. Stem erect, thick and stout, and set in a narrow depression, which may be slightly plaited. Flesh white, or nearly so, fine-grained and buttery, tender, juicy, luxuriously melting upon the palate. Requires ripening in the house a week or two.

Tree productive, and bears quite early, or young.

26. SKINLESS.

Fruit below the medium size, rather elongated, symmetrical, basal depression very narrow; the long, curved, slender stem, being quite central. Skin smooth, thin, yellowish green, having dots in the sun. Calyx closed, small, and slightly ridged. Flesh juicy, sweet and perfumed, but does not come up to first-rate.

Tree vigorous and productive. Fruit fair, and is regarded as a valuable pear.

AUTUMN PEARS.

Class I. *Height and breadth equal or subequal.*

Order I. Base acute or subacute.*

27. BEURRÉ DE BEAUMONT. (*Thompson.*)

Fruit of the medium size, wide above the crown; base subacute. Stem standing rather obliquely, rather thick, and gently curved. Color pale yellowish green, sparsely dotted with green, tinted with dull red on the sunny side. Calyx rather small; depression quite shallow and wide. Flesh white, buttery, melting, juicy and sprightly. Ripens in October, and is regarded by Downing as a rich and delicious pear.

28. DUCHESS OF MARS.

The Duchess of Mars is nearly of the medium size, wide pyriform, furnished with an obscure neck, or a slight concavity of its sides near the base; base quite obtuse, and may be furnished in some instances with a slight indentation. Stem slightly curved, stout, one inch long. Calyx small, closed, and set in a slight basin. Color yellow, cheek patched with russet, and ruddy on the sunny side.

The pear possesses all those properties, in an eminent degree, which render this fruit so valuable.

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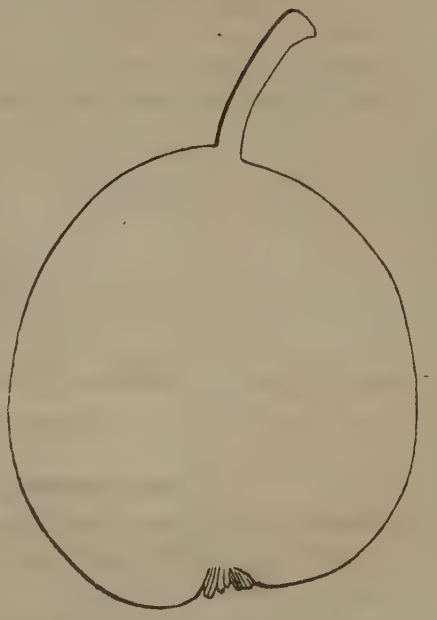
* Under the term subacute, I have placed many varieties which terminate in an obtuse base, but without depression or indentation. The Duchess of Mars is still more obtuse, but the termination can scarcely be regarded as having an indentation.

29. LOUVAIN.

De Louvain, Van Mons

Fig. 6.



The size scarcely differs from the preceding; sides without the concavity indicating a neck, slightly pyriform. Stem thick, oblique, set upon an unsymmetrical base. Color clear, light yellow, may be russeted and dotted with brown, faintly tinted with red next the sun. Calyx small, placed in a narrow, shallow basin. Flesh white, perfumed, and possessing the properties of the fine fruits.

Foreign pear, raised by Van Mons, in 1827.

30. DUNDAS.

Fruit of the medium size, cordate, scarcely turbinate; sides convex in the outline; base subacute, supporting a thick, and rather upright crown. Stem about one inch long. Color clear yellow, dotted with blackish points; cheek highly ornamented with red. Flesh yellowish white, perfumed and melting. Calyx small, placed in a moderately deep, round depression, which gives a cordate form to its section.

31. HENRY THE FOURTH.

Fruit of the medium size or less, rounded, and scarcely pyriform; base obtuse, supporting a long, slender, and slightly curved stem. Color pale greenish yellow, dotted with gray spots or points. Calyx small; depression slight. Flesh white, fine-grained, juicy and melting, perfumed and rich. Requires house-ripening. September.

Tree produces fine crops.

32. QUILLETETTE. (*Van Mons.*)

Form nearly round, wider than high, depressed, of the medium size; base very obtuse or rounded, supporting a long, curved stem. Color greenish, spotted with a brown russet. Calyx small; basin shallow. Flesh white, sweet, rich and perfumed. November.

33. ROSSELET DE MEESTER. (*Van Mons.*)

Fruit of the medium size, rounded; base subacute, bearing a long, slender stem. Color pale yellow, dotted with russet, and tinted with red on the sunny side. Calyx large, in a narrow depression. Flesh melting, juicy; flavor fine. October.

Order II. Height and breadth equal or subequal.

Base indented.

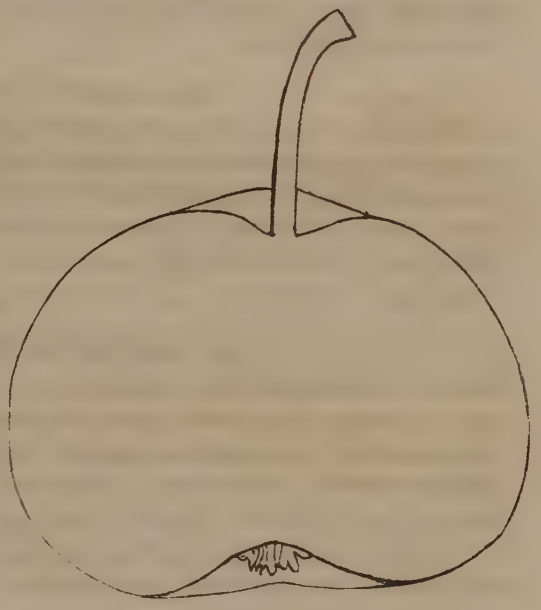
34. ALTHORPE CRASSANE. (*Thompson, Lindley.*)

Form roundish, irregular, of the medium size; ends subequal. Color pale green, sprinkled with russet dots, and slightly tinged with red on the sunny side. Stem long, slender, standing on one side, curved; depression obscure or obsolete. Calyx large; basin shallow. Flesh white, and possessing the desirable qualities in a good degree. Ripens in October and November.

One of T. A. Knight's seedlings. Downing remarks that its qualities are variable.

35. BELLE ET BONNE. (*Thompson.*)

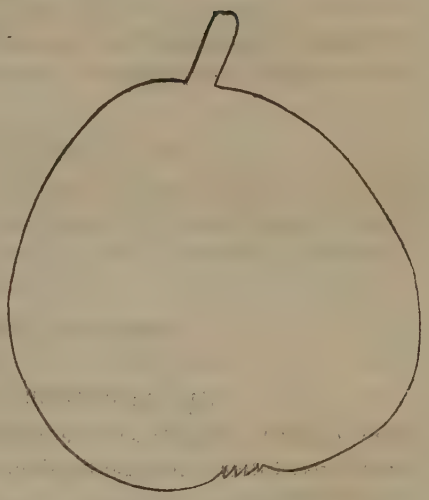
Fig. 7.



This pear is large and roundish, with an indentation, which gives a cordate form to the base. Height less than the breadth. Color greenish yellow, sprinkled with many russet dots. Stem long and slender, and curved from near its insertion; indentation deep, bordered by abrupt sides and rather wide shoulders. Calyx inserted in a shallow depression. Flesh white, coarseish, but tender, sweet and agreeable. Ripens in September.

Less delicious than Gansel's Bergamot.

36. BLEEKER'S MEADOW.* Plate 11, *d*. Fig 8.



The size is small, regular, and rather handsome, roundish, but wider than high; indentation shallow, containing a strong, erect stem, about one inch long. Calyx is inserted in a shallow basin; sides entirely rounded and convex. Flesh white, firm, quite musky, and rather inferior, as it has exhibited itself in this market. October and November.

37. BUFFAM. (*Manning.*)

The Buffam is slightly pyriform, elongated, the height and breadth being nearly equal; base rather narrow, with a small indentation. Stem stout, erect at base, slightly curved in the middle. Sides of the pear dissimilar in their curvation. Color yellow and fair, sunny side ornamented with a fine red blush. Calyx with prominent segments; depression rather wide. Flesh white, and quality higher than middling. September. Native of Rhode Island.

38. BEURRÉ DIEL. Plate 5.

The Beurré Diel is rather large, having a pyriform shape, though the neck is not well developed. Length and breadth equal or subequal. Color passing through shades of lemon and orange yellow, variegated with dots and russet patches. Stem stout, nearly erect, and set in a shallow indentation. Calyx large, being plaited. Flesh yellowish white, sugary, qualities highly recommendatory, when well ripened. In eating from September to December.

39. GOLDEN BEURRÉ OF BILBOA.

This pear is rather large, with a shape not much unlike the Beurré Diel; it is low pyriform, its height being nearly equal, with an obscure neck. Stem long, slender, slightly curved, and set in a small indentation. Color golden yellow, fair and smooth, or only slightly russeted. Calyx small; depression wide and shallow. Flesh white, melting, fine-grained, excellent. Imported from Spain.

* The character of the Bleeker Meadow is not faithfully represented by the outline cut. The stem is too short, and the indentation of the base does not appear as it should. The general form of the cut is correct

40. GANSEL'S BERGAMOT.

Form depressed, being considerably wider than high, or oblate, being flattened at both poles, though the basin is narrower than the crown; sides rounded, without a concavity or neck. Color yellowish brown, skin roughish, may be russeted and tinged with brown on the sunny side. Calyx rather large; depression deep for a pear. Stem short, straight, but oblique; indentation wide. Flesh white, aromatic, juicy, and very rich and fine. Ripens during September. One of our finest fruits.

41. BEZI DE LA MOTTE.

Its shape resembles Gansel's Bergamot, being like that pear depressed, or wider than high; sides rounded and convex, terminating in a small indentation, in which is inserted a shortish, small, erect stem, and only curved near the extremity. Color pale yellowish green, sprinkled with russetty green dots. Calyx rather large, contained in a wide depression. Flesh white, very fine-grained, juicy, delicately perfumed; fine. Ripens in October.

42. CROFT CASTLE. (*Thompson.*)

Form less pyriform than usual, being wider near the base than at the crown; sides wholly convex, terminating in a wide depression, in which is inserted a long, slender, curved stem. Crown narrow, and truncated; depression quite shallow and large. Flesh juicy, sweet and perfumed. October.

43. CUSHING.

Obscure pyriform, but without a neck; height and breadth equal or subequal, giving the pear a slightly elongated appearance. Its size is ordinary; it tapers from below the middle to a narrow, rounded base, containing a distinct indentation, from which a straight, stout stem, projects obliquely. Color light greenish yellow, sprinkled with gray dots, and may be accompanied with a redish cheek. Calyx rather small; depression shallow. Flesh white, fine-grained, and abounding in a delicate perfumed juice. Pronounced capital, and is not a stickler for particular soils. Native of Hingham, Massachusetts.

44. WHITE DOYENNÉ. Plate 14.

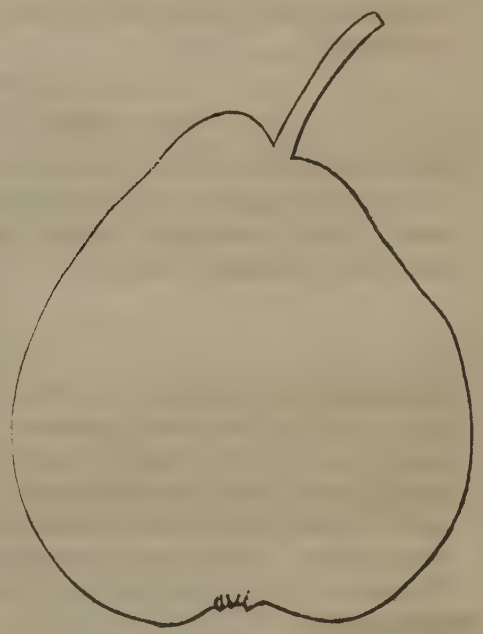
Virgalieu, White Beurré, etc.

The Virgalieu exceeds somewhat the common size, symmetrical, obscurely pyriform; height and breadth equal or subequal; sides convex all round, tapering from below the middle, and terminating in a rather wide base, with a shallow indentation, from which projects a short, strong, and nearly erect stem. Color pale yellow, smooth, dotted and fair, often ornamented with a fine red cheek. Calyx small, closed; basin quite shallow, plaited. Flesh exquisitely fine and perfumed.

Superior to all pears in the valley of the Hudson.

45. GRAY DOYENNÉ. Plate 13, *d*.

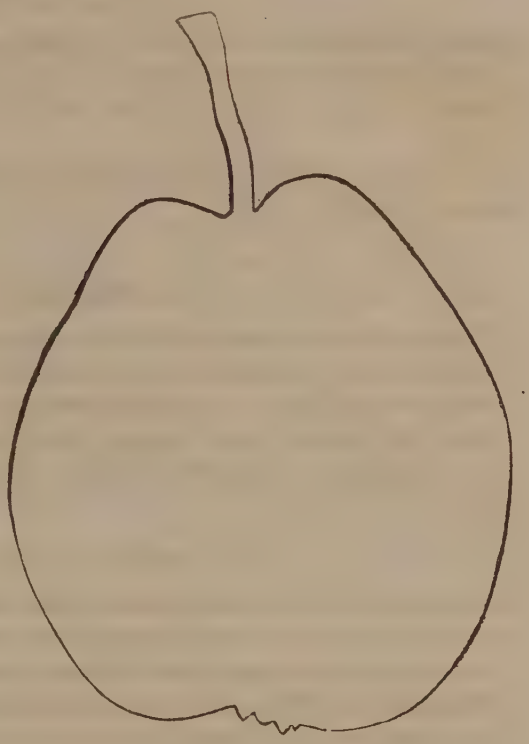
Doyenne' Gris, Gray Butter. Fig. 9.



Fruit of the medium size, obovate, obscurely pyriform, body somewhat prolonged, and extending nearly to a narrow, indented base, bearing a moderately long stem. Color redish russet; skin smooth. Calyx small, closed. Flesh fine-grained, buttery, rich and perfumed; excellent. Ripens the middle of autumn.

Regarded as first-rate, though it may fail in some localities.

46. FLEMISH BEAUTY. Plate 12, *d*. Fig. 10.



This pear is often large, tapering from below the middle to a round, cordate base, with a narrow, but rather deep indentation, from which projects a long, slender, curved stem. Height and breadth equal or subequal; obscurely pyriform, obovate, wide across the crown, with a moderately deep basin. Color pale yellow, marbled with patches of bright russet. Flesh juicy, melting, saccharine and rich, with a slight musky flavor. Last of September.

47. FONDANTE D'AUTOMNE.

Obscurely pyriform, obovate, narrowing towards the base, having rather straight, than convex sides, terminating in an obtuse base, in which the indentation is obsolete and irregular; from which a thick, straight, and moderately long, knobby stem projects. It attains the common size. Color pale yellowish green, slightly russeted. Basin moderately deep. Flesh white, juicy and delicious. Flemish.

48. FULTON.

Fruit depressed, much wider than high, oblate, less than the medium size; sides taper from the middle to wide, rounded base, containing a distinct indentation, from which a very long, slender, and only slightly curved stem projects. Color gray russet, changing as it matures to red russet, or redish brown. Calyx rather large, open; basin shallow and wide. Flesh moderately juicy, sprightly and rich; seeds compressed. October and November.

49. PETRE.

Nearly pyriform, sides nearly straight, tapering from below the middle to an obtuse base, with a large indentation, containing a stout, long, and nearly erect stem. The size is about medium. Color pale yellow, and may show a greenish russet. Basin moderately deep.

This fruit is very fine, and originated in this country, from a seed sown by the elder BARTRAM in 1735.

50. PRINCESS OF ORANGE.

Oblate pyriform, less than the medium size; wider than high; tapering from the middle to an indented, subacute base; indentation slight, and bearing an erect and rather stout stem, one inch long. Color light brown, or cinnamon and russet, becoming in the sun bright redish, tinged with Orange. Basin shallow. Flesh yellowish white, juicy, with a vinous flavor. Excellent when ripe. October and November.

51. STEVENS' GENESEE. PLATE 16, *d*.

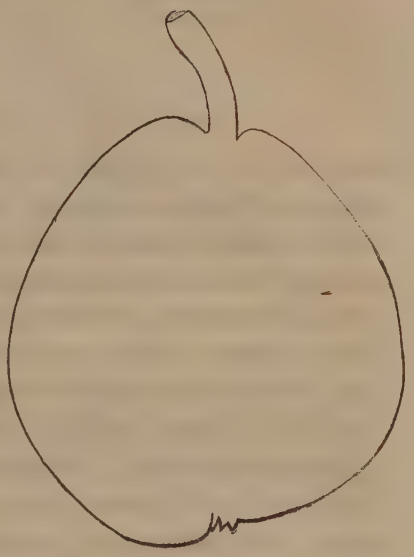
Fruit above the medium size, rotund oblate, and wider than high; sides curving regularly from the middle to a wide, rounded, indented base, bearing a stout, short, curved stem, it may be an inch long. Color yellow. Basin shallow, with an unequally raised brim. Flesh white, buttery, with a rich, aromatic flavor. Early autumn.

It is regarded as a native of western New-York, and bears the name of its original describer, Mr. STEVENS, of Rochester.

52. SECKEL.

New-York Redcheek.

Fig. 12.



Nearly pyriform, having the sides nearly straight towards the base, which is obtuse, rounded and indented, and from which there springs a short, and nearly erect stem. Color yellowish brown, ornamented with a fine red cheek. Basin shallow. Flesh white, very juicy and melting, spicy and aromatic.

This pear is a general favorite, and unsurpassed in excellency. It has, too, the advantage of a fine healthy stock or tree. It originated with Mr. SECKEL, near Philadelphia, Pennsylvania.

53. SURPASSE VIRGALIEU. *Manning.*

Fruit rather large, obovate, widest just below the middle; height and breadth equal or subequal; slightly pyriform, base obtuse and rounded; indentation irregular and shallow, from which a rather long, stout, and slightly curved stem projects. Color pale lemon yellow, and may be tinged with red on the sunny side, slightly dotted; skin smooth. Calyx depression shallow. Flesh white.

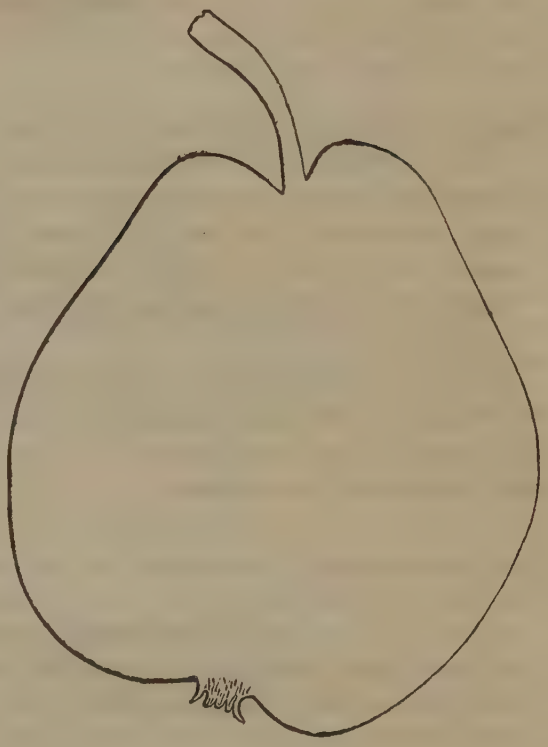
Superior in quality to most pears, in its juiciness and aroma. Tree with long, upright shoots. Productive.

Length and breadth subequal. Indented.

54. DOYENNÉ BOUSSOCK.

Fruit rather exceeding the medium size, subsymmetrical, obscurely pyriform, thick through the crown or below the middle, from which it tapers, with a nearly straight side, to an obtuse, indented base; indentation rather deep, bearing a stout stem, one inch long, sometimes fleshy. Color bright lemon yellow, semirusseted; cheek ornamented with a redish tinge. Calyx large, set in a very shallow basin. Flesh melting and juicy; flavor resembling the White Doyenné, but less delicious.

55. URBANISTE. (*Thompson.*) Fig. 13.



Large, and of a coarse form, but pear-shaped, and having an obscure, thick neck, with slightly concave sides, terminating in an obtuse, rounded base, with an irregular or one-sided indentation. Color yellow, dotted with gray, and somewhat russeted in stripes. Stem thick, straight, upright, or curved, and one inch long. Calyx large, and placed at the bottom of a deep basin. Flesh white, rich, and delicately perfumed. October.

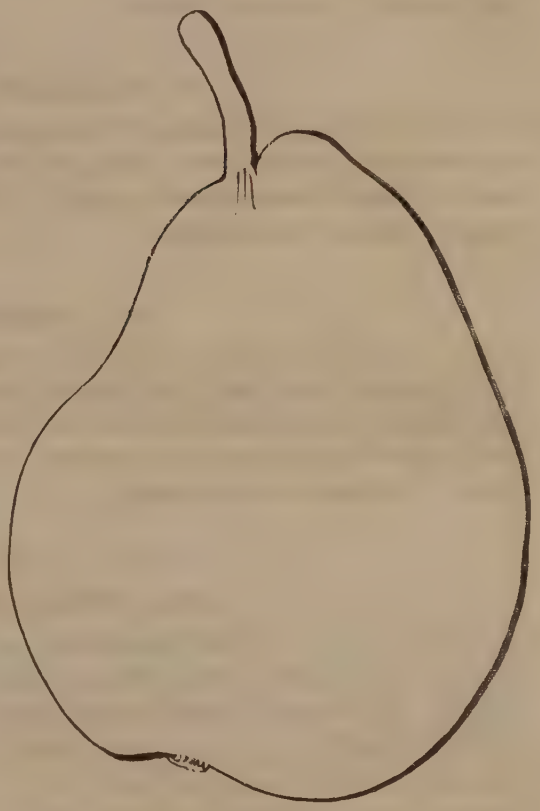
56. WILKINSON. (*Manning.*)

Form obscurely pear-shaped, inclining to oval, widest in the middle, tapering, with convex sides, to a narrow base, the indentation of which is nearly filled with the base of a thick stem. Stem low, straight, obliquely set. Crown truncated or flattened; depression obscure. Color bright yellow, dotted with brown points. Flesh white, juicy, melting, sweet and rich. November.

Originated in Cumberland, Rhode Island.

57. SWAN'S ORANGE. Plate 10, *d*.

Onondaga. Fig. 14.



Fruit large, short pyriform, body wide, tapering from near the middle towards each end, but variable; base obtuse; sides unequal, and indented; indentation shallow. Stem moderately long, and stout. Color greenish yellow, becoming yellow in ripening, dotted and may be russeted upon the crown; skin roughish. Calyx small, closed; depression narrow. Flesh juicy, high flavored and fine.

Tree productive. Its origin is unsettled, but it is extensively cultivated in western New-York, where it is highly esteemed.

58. FIGUE, OR FIG-PEAR OF NAPLES.

Fruit of the medium size, obscure pyriform, body encroaching upon the neck, oblong ovate; base wide, scarcely depressed. Stem moderately long, fleshy at base. Color yellowish brown, tinged with red on the sunny side.

The fruit possesses many of the properties for which pears are esteemed. Tree hardy and productive.

59. PRATT.

Fruit rather large pyriform. Color greenish yellow, sprinkled with russet. Stem long, slender, inserted in a regularly indented base. Basin shallow. Flesh tender, juicy, and aromatic. Ripens in October.

60. HEATHCOT. Plate.

Fruit of the medium size, symmetrical, body prolonged to the obtuse, indented base. Stem one inch long, rather stout. Color greenish yellow, marked with dots, which are often confluent, forming russetty patches. Flesh fine, and perfumed.
Origin, Waltham, Massachusetts.

61. EYEWOOD.

The size is less than common, very wide or depressed, wider than high, symmetrical; body prolonged to the base; base rounded, regularly indented, bearing a long, slender, curved stem. Color yellowish green, becoming dull yellow brown in the sun. Calyx small; depression shallow. Flesh buttery, rich and fine, subacid. Late autumn.
English. Regarded as a fine pear.

62. OSWEGO BEURRÉ.

Large, oblong; ends subequal, symmetrical; body prolonged to the base; base indented, bearing a short, rather stout, slighly curved stem. Color yellowish green, slightly russeted. Calyx small; depression shallow. Flesh juicy, subacid, and regarded by many as first-rate.

63. BERGAMOT CADETTE.

Fruit of the medium size, obovate, wide; body prolonged to the base; base indented. Stem rather long. Color greenish yellow, may be russeted, and tinged with brown on the sunny side. Calyx in a small, shallow depression. Flesh white, sweet, juicy, rich and perfumed.

64. SIEULLE. Fig. 15.

Fruit of the medium size, roundish; body prolonged to the base; sides tapering, with a regular convexity; base indented, bearing a stout stem, fleshy at its insertion. Color pale yellow, tinged with red on the cheek, sometimes the cheek is ornamented with a brilliant orange. Calyx small, placed in a shallow depression. Flesh white, fine-grained; passing from second to first-rate.

Class II. *Height greater than the breadth.*

Order I. Base acute or subacute.

65. BEURRÉ DE CAPIAUMONT.

Fruit of the medium size, turbinate, tapering regularly from near the crown to an acute base. Color yellow, dotted and striped with russet, ornamented with a fine cinnamon-red cheek. Stem rather long, small, and set upon the apex. Calyx wide; depression very shallow. Flesh fine-grained, sweet, buttery, may be astringent, but when not so, its flavor is high and agreeable.

This variety is of Flemish origin, and varies from second to first-rate. It is regarded as one of the most hardy pears, being adapted to a great variety of soil and climate.

66. BEURRÉ BOSC.

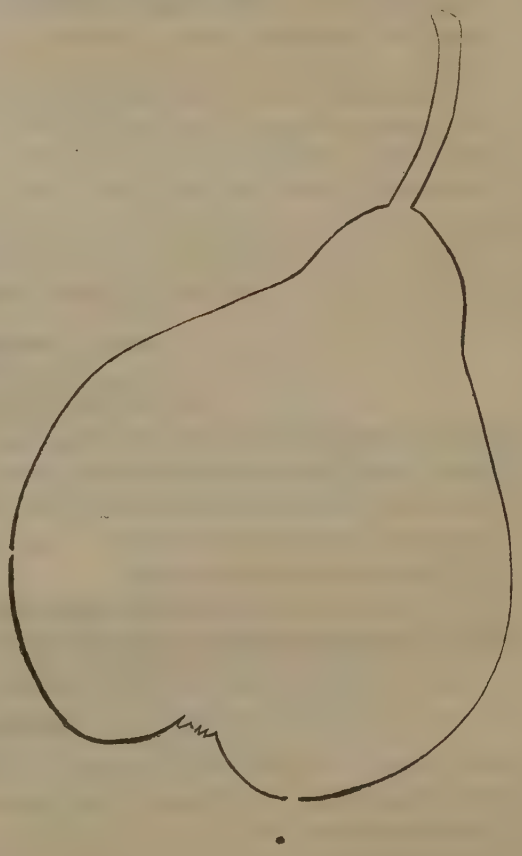
Fruit above the medium size, pyriform, body tapering rapidly to a comparatively narrow neck, terminating in a subacute apex, bearing a long, and rather slender, curved stem, curved from near the base. Color yellow, shaded darker, and russeted in cinnamon streaks and dots; cheek may be ornamented with touches of red. Calyx set in a very shallow basin. Flesh white, melting, rich and perfumed. Ripens in October.

A Belgian pear, and regarded as first-rate. Tree productive.

67. BISHOP'S THUMB. (*Thompson, Lindley.*)

Fruit long pyriform, with the neck near the middle, having concave sides, beyond which it tapers to an obtuse apex; form irregular. Stem long, with an uneven surface, curved slightly in the middle, and widening as it joins the apex, so as to set upon the end; the indentation is wholly filled with the stem. Skin knobby or uneven, dark yellowish green, sprinkled with russet; cheek redish. Calyx spreading, terminal. Flesh juicy, with a vinous flavor.

68. FREDERICK OF WURTEMBURGH. Plate 6. Fig. 16.

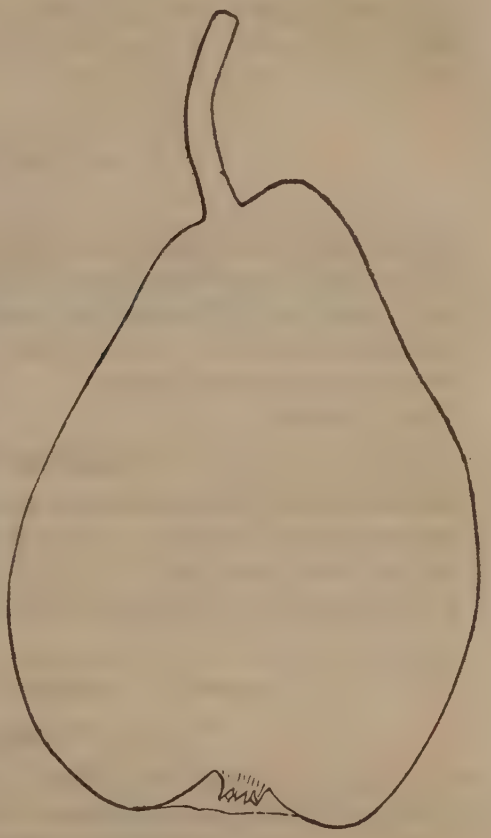


This pear is large, and unsymmetrical, pyriform, with a short, narrow neck; body wide, tapering from near the middle to both extremities; base acute, bearing a thick, curved, and rather long stem; rarely indented. Calyx open, depression shallow. Flesh white, very juicy; varies from second to first-rate, when it is buttery and excellent. Ripens in September.

Resembles Beurré Bosc, but has more body, a higher colored cheek, and a rather uneven skin.

69. LOUISE BONNE OF JERSEY. Plate 7. (*Thompson.*)

William the Fourth, etc. Fig. 17.



Fruit large, long pyriform; sides dissimilar, tapering from above the middle to an obtuse base, which may be indented. Stem moderately long, curved, and stout. Color pale green in the shade, but overspread with brownish red in the sun; skin dotted, glossy and smooth. Flesh greenish white, juicy, rich and excellent. Ripens in September and October.

70. LODGE.

Fruit of the medium size, pyriform, tapering to the stem. Color greenish brown, patched with russet. Stem long and stout, smallest at its insertion. Flesh whitish, gritty at the core, subacid and rich.

It is a native of Pennsylvania.

71. QUEEN OF THE LOW COUNTRIES.

This is a large pear, of the Beurré Bosc form, having a wide or thick body, broad pyriform. Color dark yellow, overspread with redish brown on the sunny side. Stem long, fleshy at the base, and much curved. Calyx small, set in a narrow depression. Flesh juicy and rich, subacid, with vinous flavor. Ripens in October.

72. ST GHISLAIN.

Fruit the medium size, pyriform, with a narrow neck, acute, tapering. Color pale yellow, cheek may exhibit a faint blush. Stem long, slightly curved, and fleshy at its insertion. Flesh white, buttery, juicy and fine in its flavor. Early autumn, and varies in quality from second to first-rate. Belgian.

73. VERTE LONGUE.

Long Green.

The Verte Longue is an irregularly formed pear, unsymmetrical, and long pyriform, body being narrow in proportion to its neck, and terminating in an obtuse base; crown narnow. Stem thick, rather short, and inserted on one side, scarcely curved. Color green, dotted minutely. Calyx small, terminal. Flesh white, juicy, sweet, and slightly perfumed. September and October.

Tree productive.

74. ANNAS DE ÉTÉ.

Fruit rather large, pyriform, subsymmetrical, tapering to an obtuse apex, bearing a thick, and rather long, erect stem. Color yellowish green, shaded, dotted with russet, browned on the cheek; skin rough. Calyx large, contained in a wide, shallow depression. Flesh fine-grained, buttery, sweet and perfumed. September and October.

ORDER II. Length greater than the height. Base indented.

75. ANDREWS. PLATE 8.

Fruit above the medium size, pyriform, unsymmetrical, terminating in an obtuse base. Color pale yellowish green, browned on the sunny side. Stem rather stout, curved, and inserted in a small indentation. Calyx large, occupying a wide, shallow depression. Flesh greenish white, juicy and melting, with a vinous flavor. Ripens in September.

This variety is considered as one of the most profitable pears that can be raised, though not regarded as really first-rate by MARSHALL P. WILDER.

76. DIX. PLATE 15.

Fruit above the medium size, long pyriform. Color yellow, thickly dotted with russet around the stem. Stem very stout, long, and curved, inserted in a shallow depression. Calyx small, depression narrow. Flesh juicy, melting and sugary. October and November.

The Dix is scarcely exceeded by any pear of our country. It originated in the garden of Mrs. DIX, Boston.

77. DUNMORE.

Fruit very large, inclining to oblong ovate; sides regularly convex, but unequal; base very obtuse, bearing a large, long, curved, oblique stem. Color greenish, dotted with red russet. Calyx set in a rather deep, narrow depression. Flesh yellowish white, rich, and regarded as a fine pear.

78. FORELLE.

Trout Pear.

Fruit of the medium size, oblong ovate, but more inclining to pyriform; sides dissimilar; base obtuse, bearing a slender stem, one inch long. Color green, becoming yellow in ripening, and finally tinted with a rich red on the sunny side, variegated with salmon-colored dots. Calyx set in a basin with abrupt sides. Flesh white, fine-grained, rich, and slightly vinous. November.

May be kept till the middle of December.

Higher than wide. Base indented

79. JALOUSIE DE FONTENAY VENDÉE.

Fruit of the medium size, obovate, but narrowed at the base, terminating in a half-indented, subacute base, bearing a curved, obliquely inserted stem, about one inch long. Color dull yellow, greenish, marked with dots and small patches of russet. Calyx closed, and set in a shallow, narrow basin. Flesh white, sprightly flavored. Octōber. French.

80. MARIE LOUISE. Plate 9, *d.*

Fruit large, obliquely pyriform. Color yellow, with a brown cheek. Stem long and stout, inserted in a small indentation. Calyx set in a small depression. Flesh juicy, varying in its qualities, and frequently only second-rate. September.

Height exceeds the breadth. Indented.

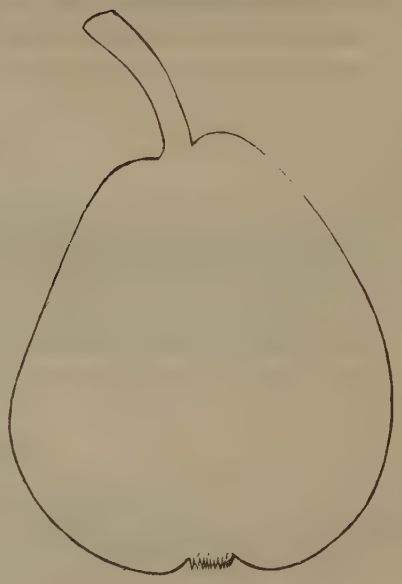
81. PARADISE D' AUTOMNE.

Autumn Paradise.

Fruit of the medium size or greater, pyriform, tapering from below the middle, with concave sides, to an obtuse and obscurely indented base; indentation obsolete from the fleshy stem. Stem long, knobby at the insertion, thick and long, curved at its articulation. Color yellowish orange, marked with confluent dots of russet; skin uneven. Calyx rather large; depression narrow, distinct. Flesh fine, rich, buttery and high flavored. Ripens about mid-autumn.

Color of the bark yellowish, growing at first upright, afterwards straggling, vigorous.

82. NAPOLEON. Fig. 18.



Fruit rather large, pyriform; body and neck short, thick, terminating in an obtuse, indented base. Color green, passing into pale yellowish green, which is its color at maturity. Stem nearly erect, stout, and one inch long. Calyx small, set in a shallow basin. Flesh white, juicy and melting. September.

An excellent pear, but requires house-ripening.

83. THOMPSON'S PEAR.

Fruit of the medium size, oblong ovate; sides convex, terminating in an obtuse, indented base, bearing a long, nearly erect, stout stem, an inch long or more. Color pale lemon yellow, dotted with russet. Calyx open; depression shallow. Flesh white, buttery, sweet, slightly aromatic, fine. October and November.

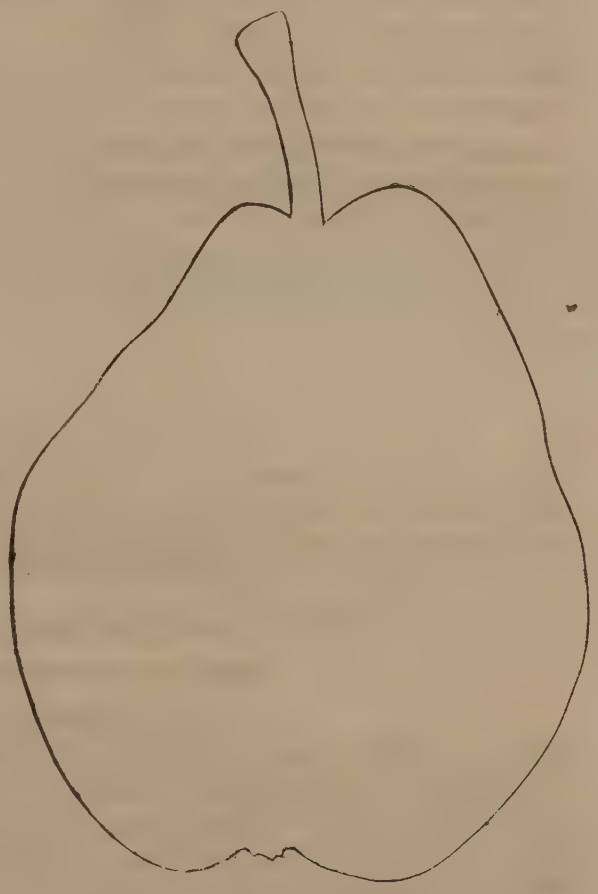
84. VAN MONS' LEON LE CLERC.

Fruit above the medium size, long pyriform, tapering gently from below the middle to an obtuse, indented base; indentation shallow, bearing a stout, oblique, curved stem, one inch or more in length. Color yellowish, variegated with brown, and slightly russeted near the stem. Calyx small; depression slight and shallow. Flesh yellowish white, rich. October and November.

85. WASHINGTON. Plate 12, *d*.

Fruit of the medium size, ovate, symmetrical, tapering gently from below the middle to an obtuse base, regularly indented, and bearing a long, curved stem; sides nearly equally curved. Color lemon yellow, dotted with brown on the sunny side; skin smooth. Calyx small; basin shallow. Flesh white, very juicy, sweet, melting and agreeable. September.

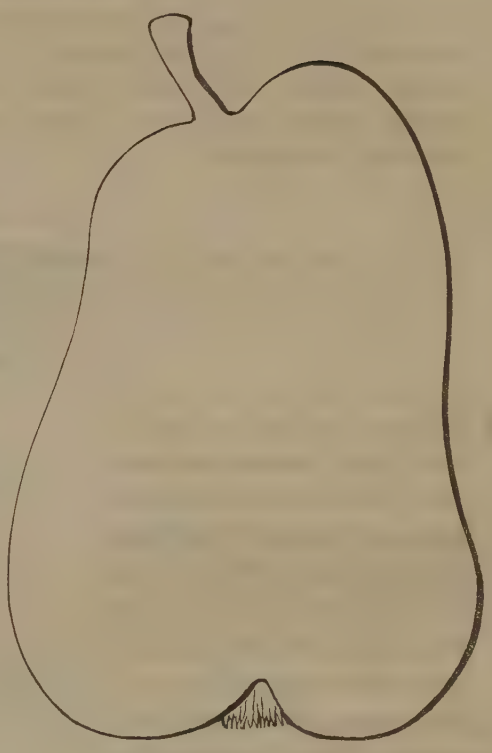
86. DUCHESS OF ANGOULÊME. Plate 11, *d* Fig. 19.



Fruit above the medium size, or very large, obtuse pyriform; body somewhat prolonged; base obtuse and indented, bearing an erect stem, one inch long. Color rich greenish yellow, marked with russet dots and reticulations; skin uneven. Calyx small; basin uneven and irregularly plaited. Flesh yellowish white, rather coarse, juicy, melting and fine. Ripens in mid-autumn.

It is to be remarked that this splendid pear is variable, passing from second to first-rate. On quince stocks its quality is superior. J. J. Thomas remarks that it is worthless on pear stocks.

87. SALISBURY'S SEEDLING. Plate 14. Fig. 20.



Fruit large, elongated; body short, with a thick, prolonged neck; base obtuse, bearing a short, recurved stem. Color yellow, sprinkled with redish brown dots, coalescing on the sunny side, and forming a brown surface; skin rather smooth. Calyx close, of medium size, inclosed in a narrow depression. Flesh white, sweet and juicy.

Comes into use in August, and continues fit for baking till October. It is one of the finest baking pears in the state. Originated with Nathan Salisbury, of Cortland county, New-York.

WINTER PEARS.

Class I. *Length and breadth equal or subequal.*

Order I. Base acute or subacute.

88. MOCCAS.

Fruit about the medium size, unsymmetrical; body prolonged to the stem; sides unequal, with unequal curves, terminating in a subacute base, and running into a thin, slender, curved stem, an inch and a quarter long. Color pale yellowish green, with a brown cheek, and sprinkled thickly with brown and russet dots and stripes. Calyx short, stiff, inserted in an unequal depression. Flesh yellowish white, juicy, and richly flavored December.

One of Mr. Knight's pears.

ORDER II. Base indented.

Height and breadth equal or subequal.

89. BEURRÉ D' AREMBERG. PLATE 10.

Large, obcurely pyriform, subsymmetrical; taper of the sides unequal, terminating in an obtuse, obscurely indented base. Color yellowish green, brighter yellow at maturity, traced and dotted with redish russet; skin rather thick. Stem thick, short, rather knobby, broad at its insertion, and nearly filling the indentation. Calyx small, and set in a distinct basin, with steep sides. Flesh white, buttery, melting, and abundant in a rich, delicious juice. December.

90. EASTER BEURRÉ. PLATE 6.

Fruit large, roundish or oval; sides subequal, subcircular and tapering, with a strong convexity to an obtuse, deeply indented base, containing a thick, short, curved stem, thickened at its articulation with the branch. Color yellowish green, sprinkled with russetty dots, sometimes a brown cheek. Calyx inserted in a wide, shallow basin. Flesh juicy, fine-grained, when in perfection in a favorable season, buttery, sugary, rich in flavor, and much esteemed.

DOWNING remarks that he has found it variable.

91. COLUMBIA.

This pear is large, obtusely pyriform, oval, with sides tapering unequally to an obtuse, deeply indented base, inclosing a long, slender, curved stem, inserted obliquely. Color green, passing in ripening to a fine golden yellow. Calyx large, set in a shallow basin. Flesh white, juicy, aromatic, excellent. Keeps till January.

The Eastern Burré and Columbia are much alike in shape; the former has a deeper and wider indentation, and a larger and shorter stem.

92. CROSS. Hovey's Magazine.

Fruit about the medium size, round; body prolonged to the stem; sides subequal, with a similar convex taper, terminating in a rounded base, with a shallow indentation, containing a short, thick, and nearly erect stem, slightly uneven. Color deep yellow, dotted with russet on the sides, coalescing into patches at the crown, ornamented with a fine red cheek; skin smooth. Calyx basin rather deep. Flesh juicy, melting, and richly perfumed. December.

93. JAMINETTE

Josephine, etc.

This pear is about the medium size, unsymmetrical, subpyriform, with sides tapering unequally, and terminating in an obtuse, obscurely indented base, supporting a rather short, thick stem, standing obliquely to the long axis of the pear. Stem one inch long, having a broad articulation to the branch. Color green, pale green when mature, marked with russet and brown dots, especially near the stem. Flesh white, juicy, sugary, with an aromatic flavor. December.

94. LEWIS. Plate 6, *d*.

Scarcely reaching the medium size, slightly pyriform or oval; sides tapering about equally in convexity to an obtuse and indented base, bearing a very long, slender, and slightly curved stem. Color dark green in autumn, marked with russetty specks, but on ripening becomes paler; skin thick. Calyx large, spreading; basin very shallow. Flesh yellowish white, melting, juicy, spicy and perfumed.

95. WINTER NELIS. Plate 86.

Fruit of the medium size, short pyriform, symmetrical; body prolonged, leaving only a very short neck, the neck itself ending in a distinctly indented base, rather narrow, and bearing a long, curved stem. Color yellowish green, sprinkled with redish brown russet, often coalescing into patches, sometimes running into irregular stripes. Calyx open, rather large, and set in a shallow basin. Flesh yellowish white, fine-grained, very melting and juicy, rich saccharine.

Keeps till January.

96. COTER.

Fruit of the medium size, pyriform, symmetrical; body tapering to an obscure neck, with nearly straight sides; neck terminating in a rather narrow, indented base, bearing a rather long stem, with an enlargement at its insertion. Color yellowish green, browned in the sun. Calyx small, with reflexed segments; depression round and shallow. Flesh white, buttery, rich, and slightly perfumed.

97. CAEN DU FRANCE.

Fruit of the medium size, short pyriform; body prolonged, at the expense of the neck, tapering from the middle; base becoming rather narrow, but distinctly indented, and bearing an erect stem, about one inch long. Color greenish gray, russeted; skin rough. Calyx rather small. Flesh tender and juicy.

Resembles in form and qualities the Winter Nelis.

98. BEURRÉ GRIS D' HIVER.

Nouveau.

Fruit of the medium size, short pyriform, obovate, obtuse. Color greenish, russeted. Stem short. Calyx depression small. Flesh greenish white, fine grained, juicy, rich, subacid.

French. New; promises well. *J. J. Thomas.*

99. CATILLAC. Plate 5, fig. 2.

Fruit of the medium size or rather large, wide turbinate or depressed, its body being quite wide; height proportionally low. Color yellow or yellowish brown, often ornamented with a brown cheek. Stem rather long and stout, set in a small indentation; basin large, shallow, and plaited. Flesh firm, hard, becomes tender in cooking, and of a redish color.

French. Keeps through the winter.

100. LAWRENCE.

Fruit large, symmetrical, obovate, tapering from below the middle to an obtuse base, rounded, and bearing a stem of medium length. Color lemon yellow, variegated with patches of greenish brown russet around the base and crown; basin plaited. Flesh yellowish white, melting and juicy, sweet, excellent.

Keeps till February. New, and promises well. Originated in Flushing, New-York.

Class II. *Length greater than the breadth.*

Order I. Base acute or subacute.

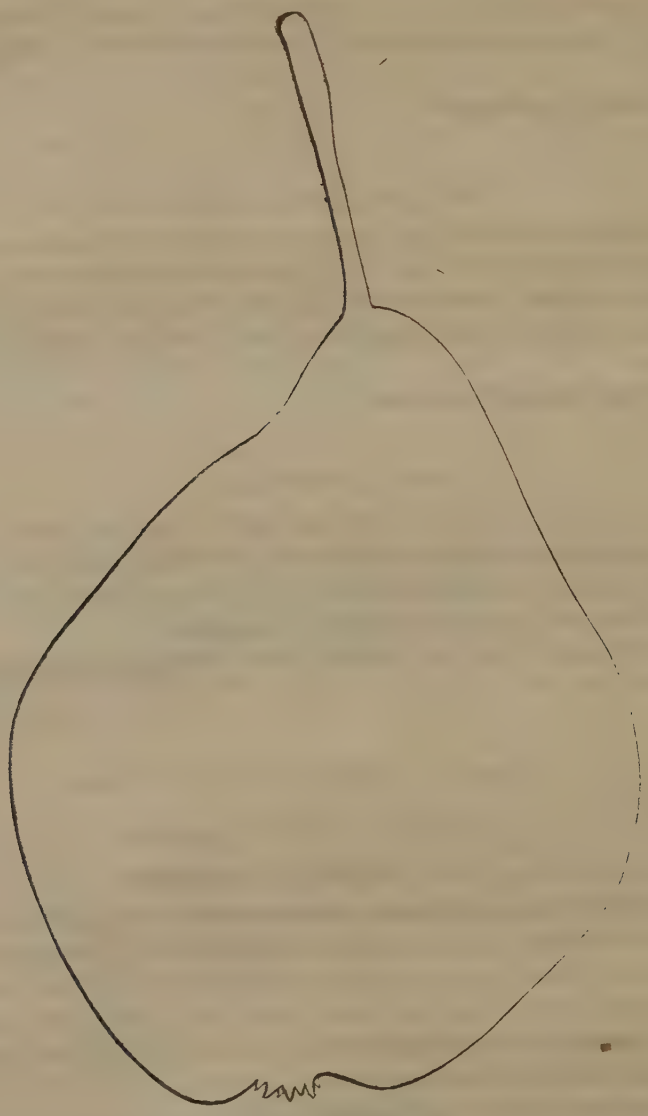
101. KNIGHT'S MONARCH.

Fruit large, somewhat oval or obovate, subsymmetrical; body prolonged to the stem, its side tapering with an equal convexity to a subacute base, (rather obtuse, and may be a slight depression,) bearing a very short, thick, erect stem, wide at its articulation. Color yellowish brown, stained with red on the sunny side, and thickly sprinkled with gray specks. Calyx open, set in a shallow basin. Flesh yellowish white, melting, buttery; possessing a fine flavor in January.

Originated with Mr. Knight, of England.

102. POUND.

Undale's St. Germain. Winter Bell. Fig. 21.



Large, pyriform, body wide. Color yellowish brown, or green, with a brown cheek. Stem two inches long, curved; basin narrow. Flesh hard, but fine for preserves, and equal, if not superior, to the quince. Tree vigorous and productive.

103. VICAR OF WINKFIELD. Plate 12. (*Le Cure', Dumas.*)

Large, long pyriform, both body and neck being prolonged; sides unequally tapering with a concavity, to an obtuse base, bearing upon it a long, obliquely inserted, slender, curved stem. Color green, becoming yellow, and may exhibit a brownish cheek; skin smooth. Calyx large, leafy, spreading, and set in a very shallow basin. Flesh greenish white, may be juicy and buttery, though not constant.

It is well spoken of by the distinguished pomologist, Marshall P. Wilder, of Boston.

104. LAS CANAS.

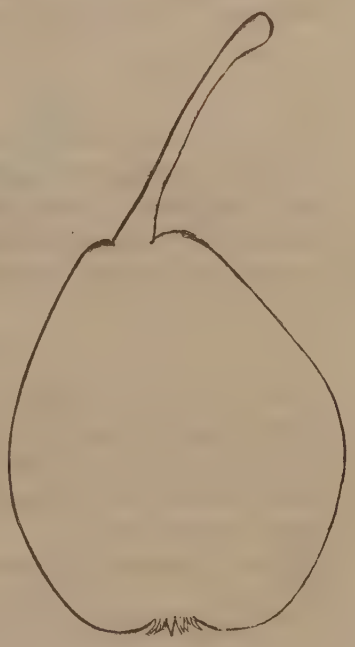
Fruit of the medium size, pyriform; sides tapering with a concavity to an acute base, and merged in the stem. Color yellow, marked with thin russet, rarely confluent. Stem an inch long. Calyx sunk in a small depression. Flesh juicy and melting.

Resembles in form the Capiaumont.

Class II. *Height greater than the breadth.*

Order II. Base indented

105. INCONNUE OF MONS. Fig. 22.



Fruit small, subpyriform, slightly compressed, tapering from near the middle to an obtuse base, slightly indented; indentation nearly filled with the flesh prolonged upon the stem, forming upon its insertion a protuberance. Color green, becoming yellowish on ripening, slightly marked with russet upon the crown; skin roughish. Stem long, slender, and curved; basin shallow. Calyx rather large, outer segments everted upon the sides. Flesh greenish white, fine-grained, juicy, subacid, tender. Very good, but not first-rate. Ripens in January.

This pear is one of Van Mon's seedlings, and though it may not rank with first-rate fruits, is still worthy of cultivation.

106. VICOMPTE D'SPOLBERCH.

Fruit rather large, obovate, tapering with nearly straight sides to an acute base. Color yellow, dotted with reddish points; skin fair. Stem thick, of a medium length, or one inch long. Flesh white, juicy, rich, melting; core of the medium size.
Wood yellow.

107. BEURRÉ DE RANZ.

Fruit of the medium size, long, and obtusely pyriform; sides tapering with an equal concavity to an obtuse, indented base, bearing a long, slightly curved, thick stem. Color dark green, marked with russet dots. Calyx small, and set in a narrow, shallow basin. Flesh greenish white, well charged with a sweet juice, accompanied with a rich flavor.

108. CHAUMONTEL. Plate 16.

This pear is large, long pyriform; neck and body prolonged, the sides tapering very gradually with a concavity to an obtuse and obscurely indented base, bearing a long, curved stem. Color yellowish only in the shade, marked with russet dots, and almost pappiliated; cheek brownish red, passing into deep red in the sun. Basin deep, angular or uneven. Flesh melting and sugary, possessing an agreeable perfume. January.

109. GLOUT MORCEAU. Plate 9.

Fruit varying from medium size to large, obscurely pyriform; body prolonged, tapering with a slight concavity to an obtuse, regularly indented base, bearing an erect, moderately long stem. Color greenish yellow, marked with green dots; skin smooth and thin. Calyx set in a moderately deep basin. Flesh white, juicy, very melting. Can scarcely be excelled in its fine qualities. December and January.

110. PASSE COLMAR. Plate 8.

Fruit large, pyriform; body short; neck rather prolonged, but variable, with sides tapering with a concavity, and terminating in an obtuse, indented base, bearing a long, stout, slightly curved stem. Color yellowish green, yellow at maturity, sprinkled with light brown russet. Calyx open, and set in a moderately deep basin. Flesh juicy, rich, sweet and aromatic.
Belgian. Regarded as possessing high qualities.

111. ST. GERMAIN.

Large, long pyriform, prolonged principally in its neck, which has rather straight, tapering sides, terminating in a narrow base, with a slight indentation, bearing a stout stem, one inch long, obliquely inserted. Calyx large; basin moderately deep. Color yellowish green, marked with specks, and tinged with brown on the sunny side. Flesh white, sweet. December.

112. PRINCE'S ST. GERMAIN.

Fruit of the medium size, obovate; body prolonged to an obtuse, rounded base, rather regularly indented, bearing a stem one inch long, slightly curved. Ground color green overspread with russet of a brownish hue, and finallly becoming dull red on the sunny side. Calyx large; depression shallow. Flesh yellowish white, juicy, somewhat vinous, agreeable. November to March.

113. BLACK WORCESTER.

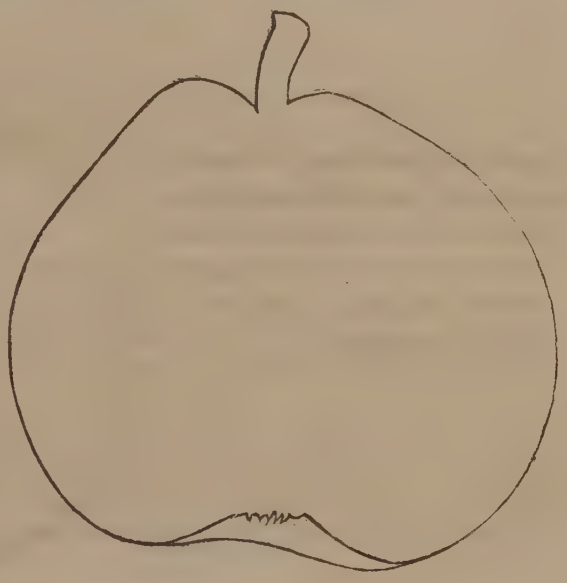
Iron Pear.

Large, pyriform; body prolonged; sides slightly concave at the neck, terminating in an obtuse base, slightly indented, but merging itself in the base of the stem. Stem long, slender, slightly curved. Color green, heavily russeted. (The stem being fleshy at its insertion, nearly fills the indentation.)

For culinary purposes.

114. GILOGIL.

Fig. 23.



Fruit large, rather depressed or low; wide through the crown and narrow at the indented base. Stem short, thick and erect; basin rather wide and shallow. Color yellowish, but reddish in the sun; skin russeted in patches or nettings. Flesh white, firm, moderately rich and nearly sweet. Regarded as an unprofitable pear in this country. Esteemed in France, its native country, for preserves.

The tree is vigorous and upright.

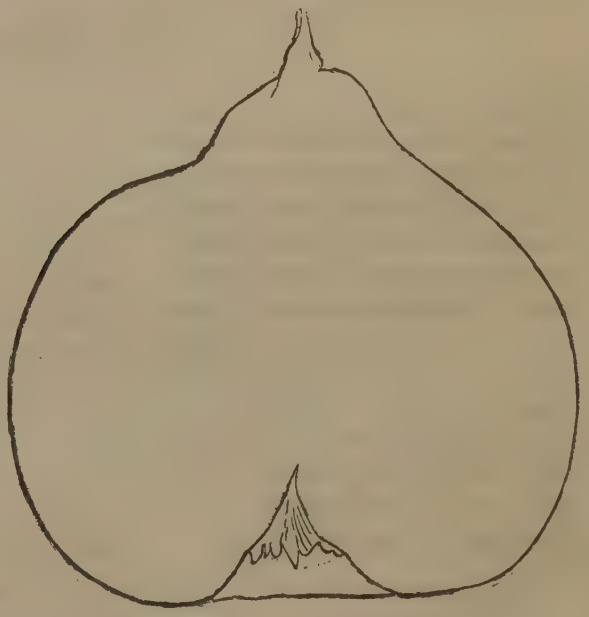
CHAPTER IV.

THE QUINCE.

The quince, like the apple and pear, reproduces itself from seed, and thereby multiplies its varieties or kinds. These, however, are far less numerous than in either of the allied fruits just mentioned. The tree is uniformly smaller and its branches are more dwarfish and straggling. Its cultivation extends back into remote periods, and has been successively cultivated by the most civilized people, and has been greatly esteemed for its fine qualities, when properly preserved and cooked with sugar or honey.

The quince for successful culture requires a rich soil and one abounding in organic matter and the alkalies. It is quite necessary that it should receive much water, and hence when it is planted in yards which receive the washes from the kitchen it is not only more healthy and vigorous as a tree, but far more productive and profitable. Its position, too, should be one where it is defended by buildings or high fences. High and cold winds injure the fruit, and at the same time cause it to fall prematurely. The tree may be propagated from the seed or from layers or slips. The latter is by far the most expeditious mode, besides it furnishes the only mode, except grafting or budding, by which good varieties may be secured. Only one variety will be described.

1. APPLE QUINCE. Fig. 1.



Fruit of the medium size, obscurely pyriform; body wide, neck short, base narrow, terminating in a stem fleshy at base. The variety is perhaps as valuable as any which has been cultivated.

CHAPTER V.

THE PEACH.

The excellence and value of this fruit is universally acknowleged. It is unnecessary to compare a good peach with a good pear; they are so different in kind and the qualities so unlike that comparison fails; we may as well compare a pudding with a pie. Both fruits add materially to our enjoyments, and extend the limits of healthful luxuries. The idea that effeminacy is somehow or other connected with such luxuries should not be entertained. The cultivation of these fruits belongs to a species of refined civilization which is incompatible with the early and lower grades of advancement: it belongs to the same grade of civilization as the culture of wheat. The savage may plant his corn and dry his roots, but it only consists in acts but little higher than those performed by the rodents of the forest, who come in and divide with him a share of these vegetable products. The improvement of kinds, by the institution of a system of means, requires an advance in a knowledge of the nature of the vital forces. It is true there may exist a fund of practical information derived from observation and the experience of many generations, without a remarkable advancement in the higher arts, as the application of steam or electro-magnetism, as a moving power. The Chinese excel in the production of varieties; they have advanced far on this road of civilization, while in many other directions they remain in the back ground. The cultivation of the peach is not difficult. A sunny warm climate, however, favors a perfect development of its superior qualities. In the damper and cooler atmospheres, protection and shelter under walls compensate in part for deficient temperature and a want of bright and sunny atmosphere. This fact is illustrated by the artificial conditions required in the cultivation of the peach in England.

The peach tree is easily grown and easily propagated, but to secure good, or at least supeperior fruit requires a knowledge of the peculiar characters of the species, and skill in rearing the tree, embracing a knowledge of the means of imparting the requisite amount of vigor which perfect fruits demand.

Those who have not turned their attention to fruit culture, are liable to fall into neglect in treating this and other trees. The idea that trees can take care of themselves when planted in orchards, that there can be no lack of nutriment, does not seem to have been suspected; and hence when it grows slowly, lacks vigor and bears an inferior fruit, the

poor tree is cursed for not being what it can not be, because it is forced to stand in a lean soil and bear the peltings of storms and winds without protection and without nutriment. We are apt to think that inanimate beings may be left to shift for themselves. We fear there may not be a due degree of sympathy for these beings: yes, sympathy, even for inanimate beings, and we fear that where this is really wanting, we might reasonably expect that those persons will neglect their cattle, starve their sheep, and drive their horses unmercifully.

But the subject of fruit culture is getting to be understood. Read the books published by the elder and younger THOMAS and the DOWNINGS, and all who reflect will see that a better day has risen upon fruit culture.

It is supposed, and even maintained and practiced upon, that a light, sandy soil is best for the peach. There is probably an error in this view of the matter; and it is undoubtedly favored by the fact that the tree can live, and produce much and very good fruit, under these circumstances. When, however, we take into consideration, that the peach is shorter lived when planted in a light soil, and that it must necessarily take from the soil a large amount of those matters which constitute the wood, foliage and fruit, we must of necessity come to the conclusion that the soil in which the tree stands becomes exhausted, and it becomes first feeble for want of nutriment and finally perishes from starvation. Very little of true economy is put in practice when the peach is cultivated on a large scale. The orchardist is too prone at least to act upon the supposition that, as the tree is short lived it is necessary to obtain the most from it; and hence, allows it to bear exhausting crops, and that without a thought of giving to his orchard nutriment. Hence premature old age comes on. This view of the subject appears the more natural when we find peach trees growing in a better soil and where annual supplies of nutriment are furnished they attain a great age, as in a garden or standing near dwellings, where both nutriment and protection from winds are furnished. The idea that a light soil—and I mean by a light soil one which is poor in the earthy and alkaline phosphates and other mineral matters—is adapted to any fruit tree, is entirely fallacious. It is here that it maintains, it is true, an existence; it lives, but it is precluded from permanent fruit bearing, because the essential elements of all fruits come from the soil. There are, it is true, certain plants adapted to a most meagre soil, as the lichen upon the rock, or the cuticle of a tree; others maintain an existence in clefts of rocks upon high mountains, just below the limit of perpetual snow; but in these cases there is a constitutional adaptation to circumstances. The plants appear necessarily stinted; climate, however, is the controling element in these cases. No time is given for the growth of foliage, which indicates a rich soil, and the functions of the plant are limited to the production of seed in a capsule, which is sessile upon the earth. Whatever may be true of certain thorn-bearing shrubs and alpine plants is certainly not true of fruit-bearing trees. We may take a lesson on fruit raising from the whortleberry. This fine shrub, with its delicate fruit, springs up in soils where the alkalies abound; but as soon as these are measurably exhausted it ceases to yield supplies of fruit, and in a few years the plant itself dies out,

or disappears: burn over the fields and supply the alkalies from the burnt wood and the whortleberry appears again, as flourishing and productive as ever. Who doubts that the plant would bear continuously for years if the alkalies, so essential in this case, were only supplied. The same holds true with the peach and all other fruits. To supply continual crops and prolong the life of the tree give it its food, and it will continue to bear for an indefinite period. It should be nourished, and in giving nourishment it is quite essential to remember that certain trees require something specific. Some require potash and all the alkaline and earthy phosphates. So there is undoubtedly certain specific modes of treatment of the roots which will favor the constitutional character of the tree.

The native country of the peach is not well determined; the common opinion, however, is that it is a native of Persia; but, as in the case of others, and indeed most of our domesticated fruits and animals, their origin goes back to a period anterior to the historical era; and the countries severally assigned as having furnished the parent stocks do not produce them in an unculivated state. There must, therefore, remain much uncertainty in questions concerning the origin of fruits whose cultivation extends back to the remotest periods.

The peach has been extensively cultivated by all civilized nations wherever the climate has been favorable. It has followed the race in its wanderings, and in consequence of its easy propagation; has, in its class, furnished a luxury of the highest grade. It is well known that the qualities of the peach are modified by climate and modes of cultivation. Where the climate is in a degree unfavorable, the rearing of trees against walls and protecting screens overcomes the disadvantage, and fine, large and juicy fruits are grown. Scarcely any fruit so well repays for the skill which may be brought to bear upon its production.

The peach, in the course of time, has broken up or into an immense number of varieties and still new ones are produced. These varieties, however, do not bear those characteristic marks which may be used for distinctions of kinds, as in the apple and pear. The form of the peach, as it grows in this country, is not very variable; there are large and small peaches, and peaches whose flesh is yellow, and those where it is white; some whose flesh clings to the stone, others where it separates readily; and again some whose flesh is only moderately adherent.

Peach trees exhibit marked difference in the color and size of their blossoms. The leaves differ in their serratures as well as in the appendages at their bases which are called glands; some furnish one or more, while others are destitute of them.

A variety still more strongly marked is furnished in the nectarine, or peach with a smooth skin. The same variations occur in the adhesion of the flesh to the stone as in the common peach. The nectarine tree is smaller, and more delicate for standards in gardens and ornamented enclosures than the peach. Its fruit, however, is less rich but has the advantage of ripening at an earlier day, and hence is well worthy of cultivation.

SYNOPSIS OF THE VARIETIES.

Class I. *Flesh free and light colored.*

Section I. Leaves without glands.

A. Flowers large.

Magdalen of Courson. Fruit below the medium size; suture deep on one side. Whitish; cheek red.

Early York. Fruit of the medium size; suture slight; in the shade greenish white and dotted red; dark red in the sun.

Noblesse. Full medium size; narrowed and pointed at the apex.

Sweet Water. Fruit of the medium size. Flesh tinged reddish at the pit or stone.

Early Ann. Fruit below the medium size; stone smoother than common. Flesh faintly tinged red. Unprofitable.

Double Mountain. Fruit of the medium size; rounded and narrowed at the apex.

Malta. Rather above the medium size; suture wide and shallow.

White Nutmeg. Small, oval; suture deep; nearly white.

B. Flowers small.

Early Tillotson. Fruit of the medium size; suture deep. Dotted with red on a white ground.

Red Rareripe. Rather above the medium size; suture wide, passing nearly round the fruit.

Royal George. Large; suture deep at the apex. Color whitish and thickly dotted.

Emperor of Russia. Large; unsymmetrical.

Royal Charlotte. Large; suture moderate. Fesh pale; red at the stone.

Section II. Leaves with globose glands

A. Flowers large.

Astor. Fruit large; apex depressed, suture distinct. Color white, with a red cheek.

Clinton. Fruit of the medium size; suture nearly obsolete

Grosse Mignone. Large; apex depressed; suture deep.

Early Admirable. Fruit of the medium size; round and white, or nearly so.

Acton Scott. Fruit of the medium size; suture shallow. Skin white and rather woolly.

B. Flowers small.

Bellegarde. Fruit of the medium size; suture shallow; apex projecting.

George the Fourth. Fruit large; suture deep and wide. Slightly red at the stone.

Large Early York. Fruit large. White in the shade and dotted; cheek red in the sun.

Cole's Early Red. Fruit of the medium size; suture small. Skin mottled with red.

Cooledge's Favorite. Fruit of the medium size; suture distinct at the apex.

Morris' Red Rareripe. Fruit large, roundish; suture moderate.

Prince's Rareripe. Fruit of the medium size; suture rather deep and broad; apex depressed. Skin downy and marbled.

Oldmixon Freestone. Large; suture obsolete, except at the apex. Pale yellowish white, marbled; cheek red when exposed.

President. Large; suture small. Skin very downy and yellowish white, tinged with green.

Washington. Large; suture broad and deep. Yellowish white; cheek crimson.

White Imperial. Rather large; apex depressed, suture moderate. Yellowish white.

Ward's Late Free. Large, roundish. Dull yellowish white; cheek red.

Nivette. Large; suture slight; apex depressed. Color light yellowish green; cheek only a faint red.

Section III. Leaves with reniform glands.

A. Flowers large.

Early Purple. Fruit of the medium size; suture deep at the apex. Color light yellow.

White Blossomed Incomparable. Large, oval. Color white; flesh white.

B. Flowers small.

Brevoort. Fruit of the medium size; suture distinct, deep at the apex.

Chancellor. Large, oval; suture distinct. Color nearly white.

Early Newington Freestone. Fruit of the medium size; suture distinct. Color white, dotted and partially striped with red; cheek red.

Morris White. (White Rareripe). Large; suture small. Color pale at maturity.

Kenrick's Heath. Large; suture slight; apex pointed.

Cole's White Melocoton. Large, roundish; pale.

Strawberry. Fruit of the medium size; suture deep.

Snow. Large, globular; suture distinct at the apex.

Sub-Class. *Flesh free. Yellow fleshed Peaches.*

Section I. Leaves crenate, with globose glands.

A. Flowers large.

Baltimore Beauty. Fruit below the medium size. Color orange. Flesh reddish at the stone.

B. Flowers small.

Early Crawford. Large, roundish, unsymmetrical; suture shallow. Yellow. Ripens end of summer.

Crawford's Late. Fruit above the medium size; suture shallow. Yellow; cheek red; flesh red at the stone. Ripens last of September.

Red Cheek Melocton. Large; apex pointed. Yellow; cheek red; flesh red at the stone.

Yellow Rareripe. Large; suture moderate. Color deep orange, dotted; cheek red. Flesh red at the stone.

Yellow Alberge. Fruit of the medium size; suture distinct. Yellow; cheek purplish.

Section II. Leaves with reniform glands.

A. Flowers large.

Yellow Admirable. (Orange peach.) Large; suture small, confined to one side. Yellow. Stone small.

B. Flowers small.

Bergen's Yellow. Very large; suture distinct. Color orange; cheek red.
Columbia. Large; suture distinct. Skin rough, dingy red.

Class II. *Flesh adherent to the stone, and pale colored.*

Section I. Leaves without glands.

A. Flowers large.

Old Newington. Large; suture slight. Color white; cheek red. Flesh red at the stone.
Smith's Newington. Fruit of the medium size; rather unsymmetrical.

Section II. Leaves with globose glands.

A. Flowers small.

Large White Clingstone. Large; suture only slight; point at the apex small.
Oldmixon Clingstone. Large; suture distinct at the apex. Yellowish white, dotted with red; cheek red.

Section III. Leaves with reniform glands.

A. Flowers small.

Catharine Cling. Large; suture shallow; form unsymmetrical. Color pale yellowish green, dotted with red.
Heath. (White Heath.) Very large, round; point at the apex large. Color pale yellowish white. Suture distinct.

Sub-Class II. *Flesh adherent. Flesh deep yellow.*

Section I. Leaves without glands.

A. Flowers small.

Orange Clingstone. Large, round; suture distinct, passing nearly round the fruit.

Section II. Leaves with reniform glands.

Lemon Clingstone. Large; point prominent.
Tippecanoe. Large, round. Yellow; cheek red.
Washington Clingstone. Fruit of the medium size. Yellowish green; with gray specks.

Class III. *Flesh purplish crimson.*

Section I. Glands reniform

A. Flowers small.

Blood Clingstone. Fruit above the medium size; suture distinct. Color dark purplish red. Flesh deep red.

DESCRIPTION OF SOME MOST VALUABLE VARIETIES OF PEACHES FOR THE STATE OF NEW-YORK.

I. *Freestones. Flesh light colored.*

A. Flowers large.

1. MAGDALEN.

Madeleine de Courson. Red Magdalen. True Red Magdalen. French Magdalen. Madeliene Rouge.

Fruit rather less than the medium size, round. Color rather white; cheek of a lively red. Flesh white, and reddish at the stone; juicy, with a rich vinous flavor. Ripens near the middle of August.

The Magdalen is regarded as a valuable peach, being both excellent and productive, as well as hardy. It is of French origin and not extensively known in this country.

2. EARLY YORK.

Early York of Downing. *Large Early York. Serrate Early York of* Thomas.

Fruit of the medium size, roundish; suture slight; form symmetrical. Color rather pale red, and thickly dotted; in the sun, dark red. Flesh greenish white; tender and melting; juicy and rich. Ripens near the middle of August to the first of September.

The Early York has been cultivated extensively in the peach growing States, and is one of the most popular early peaches. Downing remarks that it should have a place in every garden.

3. NOBLESSE. Plate 69.

Vanguard. Mellish Favorite.

Fruit of the medium size or larger, roundish or oblong, terminating at the apex in a distinct acute point. Color pale yellow, with a greenish tinge, and rather clouded, and shaded with a dull red in the sun; deeper around the apex. Flesh pale greenish white; juicy, with a high and rich flavor. Stone rather small, around which there are a few radiations of red.

The Noblesse is of English origin, and has ever borne a high reputation for its good qualities. It ripens the last of August. The tree is hardy and productive.

4. MALTA

Fruit rather large; suture broad and shallow, Color pale green, but dotted or mottled with dull purple in the sun. Flesh greenish, slightly red at the stone; juicy and melting; sub-acid, with a fine vinous flavor. It bears moderately. Ripens the last of August.

B. Flowers small.

5. EARLY TILLOTSON.

Fruit of the medium size, round. Color quite red on a pale yellow ground, and dotted with red; the sunny side dark red. Flesh whitish, but reddish around the stone; slightly adherent; melting, juicy, with a high and fine flavor.

It is regarded as one of the superior early fruits; ripens early in August. It was first brought to the notice of the public by J. J. Thomas, of Macedon. Originated in Central New-York.

6. RED RARERIPE.

Early Red Rareripe. Large Red.

Fruit of the medium size, sometimes large; suture broad and deep, passing nearly around the fruit. In the sun the color is a rich red; in the shade pale or white, and only dotted with red. Flesh whitish; reddish at the stone; juicy, rich and high flavored. Ripens the last two weeks of August.

Section II. Leaves crenate, with globose glands

A. Flowers large.

7. GROSSE MIGNONE.

Fruit large, roundish, with a depressed apex; suture deep. Color greenish yellow, mottled with red; cheek purplish. Flesh reddened at the stone; juicy, flavor rich and somewhat vinous. Stone small and rough. Ripens the two last weeks of August.

It is of French origin. Regarded as one of the first peaches of the season.

8. EARLY ADMIRABLE.

Fruit of the medium size, and round Color nearly white, with a red cheek and reddish flesh at the stone. Juicy, rich and sweet.

B. Flowers small.

9. GEORGE THE FOURTH.

Fruit large, round, with a deep broad suture; slightly unsymmetrical. Color nearly white when shaded, and dotted red, with a deep red cheek. Flesh red at the stone; juicy and rich. Ripens at the end of August.

Originated in the State of New-York. It bears moderately only.

10. LARGE EARLY YORK.

Honest John.

Fruit large. Color nearly white in the shade, and dotted with red; cheek red in the sun. Flesh white, fine grained, very juicy; flavor fine and excellent; the New-York Rareripe so closely resembles the Large Early York, that it is generally regarded as nearly identical.

11. LATE RED RARERIPE. Plate 66.

Prine's Rareripe.

Fruit large, roundish oval; suture wide and deep. Color pale grayish yellow. Skin downy, spotted and marbled; in the sun dull red. Flesh white, red at the stone; juicy, with a rich high flavor, and ripens the first weeks of September.

12. OLDMIXON FREESTONE.

Fruit large, roundish, slightly unsymmetrical; suture distinct at the apex. Color pale yellowish white, marbled with red; cheek deep red in the sun. Flesh deep red at the stone; tender and juicy, excellent. Ripens early in September. Hardy and succeeding in most places.

13. WHITE IMPERIAL

Fruit of the medium size, or larger, roundish; apex depressed; suture moderate. Color pale yellowish white, often tinged greenish; often purplish in the sun. Flesh juicy, delicate, and most excellent. A valuble northern peach.
Originated in Cayuga county, New-York, with David Thomas.

14. WASHINGTON.

Washington Red Freestone.

Fruit large, inclining to oblate; suture broad and nearly encircling the peach. Color yellowish white; cheek deep crimson. Skin thin. Flesh whitish, tender, juicy and rich. Stone small, to which the flesh is slightly adherent. Late. Originated in New-York.

Section III. Leaves with reniform glands.

A. Flowers large.

15. WHITE BLOSSOMED INCOMPARABLE.

Fruit above the medium size. Color white externally and internally. Juicy and pleasant. Ripens early in Autumn.

B. Flowers small.

16. BREVOORT.

Brevoort's Seedling.

Fruit of the medium size, round; suture distinct and deep at the apex. Color whitish; cheek bright red. Flesh white, slightly red at the stone. High flavored and regarded by Downing as one of the most delicious of peaches. It bears regularly moderate crops and ripens the first of September.

Originated with Henry Brevoort, Esq. of New-York.

17. EARLY NEWINGTON FREESTONE.

Newington Peach. Early Newington.

Fruit large, with a distinct suture, and slightly unsymmetrical. Color pale yellowish white, dotted and streaked with red; cheek red. Flesh white; red at the stone; slightly adherent, but in different degrees; juicy and melting, with a fine vinous flavor. J. J. Thomas remarks, that it is an early, valuable variety, ripening immediately after the Serrate Early York. Tree a moderate bearer.

18. MORRIS WHITE.

Morris White Rareripe. White Rareripe. Lady Ann Steward.

Fruit of the medium size, oval or roundish oval; suture small. Yellowish white, sometimes tinged with purple in the sun. Flesh firm and white, melting and juicy Ripens early in Autumn.

The Morris White is very generally esteemed and cultivated, and is a very fine fruit where the climate is suitable, as in the neighborhood of Philadelphia. The White Imperial, however, is regarded as a better kind for New-York. It is of American origin, and ripens the middle of September.

Class II. *Flesh dull yellow.*

Section I. Leaves crenate, glands globose.

A. Flowers small.

19. EARLY CRAWFORD.

Crawford's Early Melocoton.

Fruit very large, roundish oval; pointed at the apex; suture shallow. Color yellow; cheek red. Flesh juicy and rich, slightly acid. Ripens at the beginning of Autumn. Late production.

20. YELLOW ALBERGE.

Golden Mignonne.

Fruit of the medium size; suture distinct and half encircling the fruit. Color yellow, with a purplish red cheek. Flesh yellow, and red at the stone; juicy and sweet. Ripens near the middle of August.

21. YELLOW RARERIPE.

Fruit large, roundish; suture shallow, extending more than half round the peach. Color orange yellow, dotted with red; cheek red. Flesh deep yellow; red at the stone; melting and juicy. Regarded as one of the finest American seedlings.

22. EARLY BARNARD. Plate 64.

Fruit of the medium size, oblong; suture wide and deep; apex depressed. Color red and somewhat dotted; flesh yellow, tinged red near the stone, in patches. Flesh yellow; juicy and rich, with a fine flavor.

This variety is cultivated in western New-York, where it is highly esteemed.

23, WHITBECK'S YELLOW SEEDLING. Plate 65.

Fruit large, roundish oval; suture extending half round the fruit, rather deep; apex slightly prominent. Color orange, finely dotted. Flesh yellow to the stone; juicy and rich. Exhibited at the Buffalo fruit convention, 1847.

24. GOLDEN RARERIPE. Plate 68.

This is a New-Jersey seedling, furnished by Dr. Ward. It is a very fine and beautiful peach, which has not been cultivated as yet sufficiently to test its comparative value. It is placed in this connection for easy reference. The figure is characteristic of the kind.

Class II. *Flesh adhering to the stone and of a pale or light color.*

Section I. Leaves without glands.

A. Flowers large.

25. OLD NEWINGTON.

Newington.

Fruit of the medium size or larger; suture only slight. Color white, with a fine red cheek. Flesh white, red at the stone; juicy and moderately rich. Ripens by the middle of September.

SECTION II. Leaves with globose glands.

B. Flowers small.

26. OLDMIXON CLINGSTONE.

Fruit large, roundish oval; apex marked by the suture; slightly unsymmetrical. Color yellowish white, dotted with red. Flesh juicy, with a high flavor.

SECTION III. Leaves with reniform glands.

27. CATHARINE CLING.

Catharine.

Fruit large, roundish oval; unsymmetrical; apex pointed. Color yellowish green, dotted on the sunny side; the cheek is reddened and striped. Flesh tinged with yellow; adherent to the stone; juicy and rich. Ripens the middle and last of September.

CLASS III. *Flesh purplish crimson.*

SECTION I. Glands reniform.

B. Flowers small.

28. BLOOD CLINGSTONE.

Fruit very large, roundish oval; suture distinct. Flesh deep red, firm and juicy. Employed for pickling and preserving. Interesting rather than a useful variety.

CHAPTER VI.

THE PLUM.

The classification of the varieties of plum has been effected in part by the color of the fruit; thus plums are divided into the light and dark varieties; the first embracing the green, white or yellowish white kinds, the second the red, purple and blue kinds. A subdivision is founded upon the adherence or non-adherence of the flesh to the stone, as in the instance of peaches. Mr. J. J. Thomas has employed size as a farther subdivision, yet with due deference to authority so good, I should always prefer some other, inasmuch as size is a character too variable to be applied with a sufficent degree of certainty. It is true that there are many cases where size is not very inconstant, under the same climate and the same culture; but in most cases it is a character too variable for the employment of the naturalist.

The following arrangement I propose to adopt in the classification of the plum.

Class I. *Fruit white, or yellowish white, yellow or green.*

Order I. Flesh free of the stone.

Order II. Flesh adherent to the stone.

Class II. *Fruit red, purple or blue.*

Order I. Flesh free.

Order II. Flesh adhering to the stone.

Class I. *Color white, yellowish white, green or yellowish green.*

Order. I. Flesh free.

1. IMPERIAL GAGE.

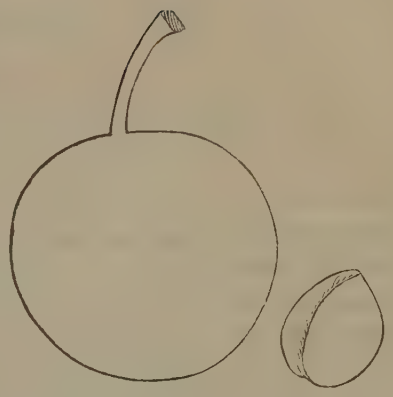
Flushing Gage.

Fruit rather above the medium size; oval, with a distinct suture, symmetrical; base evenly depressed. Color yellowish green; skin marbled in obscure greenish stripes, and covered with a whitish bloom. Flesh generally free, greenish, rich and juicy, when on good soils. Tree productive.

This variety was produced from the Green Gage, at Prince's nursery, Flushing, N. Y. Downing remarks that it requires a dry light soil, and that it is insipid when grown upon clay or heavy soils.

2. GREEN GAGE.

Fig. 1.



Fruit of the medium size, roundish, or round; suture rather shallow and indistinct, base scarcely depressed for the insertion of the stem. Stem ¾ of an inch long. Color greenish, and when exposed to the sun it receives a slight purplish tint, through which the yellowish green appears in faint blotches. Flesh free, firm, yellowish green, with whitish fibres running from the stone to the skin, and also traversed by whitish lines or veins. Taste sweet, mingled with a pleasant subacid, without an unpleasant bitterish acid at the skin, highly flavored. Stone destitute of a marginal groove. Ripens in Albany the first of September, and continues two or three weeks. Scarcely exceeded in excellence by any plum in this climate.

3. JEFFERSON.

Fruit rather large, oval and slightly elongated, giving thereby a narrowed base, and scarcely depressed; suture only slight. Color greenish yellow; in ripening becomes of a golden yellow, and faintly tinged red in the sun. Bloom thin and white. Stem about one inch long. Flesh yellow, juicy and only slightly adherent, or by a few fibres; flavor rich and excellent. Stone long and pointed. Ripens in Albany the first of September. Origin Albany.

4. LAWRENCE FAVORITE.

Fruit rather large, oval, height greater than the breadth, wide and flattened at base, depression shallow. Color yellowish green; bloom light, with a tinge of bluish green. Stem rather short. Flesh greenish, juicy, and for excellence stands next to the Green Gage. Ripens the last of August.

5. WASHINGTON.

Bolmar.

Fruit above the medium size, round; breadth greater than the height; suture obscure. Color yellowish green, and faintly marbled; in the sun suffused with a faint blush. Stem ¾ of an inch long. Flesh yellowish, firm, sweet, free and moderately rich. Ripens in the last of August.

Originated in New-York city, and is a general favorite, though inferior to the Green Gage. Tree productive, has a rapid growth, and succeeds well upon a variety of soils.

6. ALBANY BEAUTY.

Dennison's Albany Beauty.

Fruit of the medium size, perhaps less, oval; height and breadth subequal; suture obsolete, rounded at base, and without depression. Color yellowish green, or whitish green, dotted. Bloom thin and rather purplish. Stem long and slender. Flesh yellow, moderately juicy, sweet and free. Stone pointed, sharp, and leaves downy.
Originated in Dennison's garden, Albany, N. Y.

7. BLEECKER GAGE.

Fruit rather above the medium size, or less; roundish, oval, symmetrical; height greater than the breadth, widest at the base and slightly depressed; suture obscure. Stem long and rather stout, ciliated. Color yellow. Bloom thin, white. Flesh yellow, nearly free, rich and sweet. Ripens about the first of September at Albany, where it originated.

8. DENNISON'S SUPERB.

Fruit of the medium size, round; suture distinct and extending nearly round the fruit. Color yellowish green, and ornamented by purple blotches and dots. Flesh yellowish, moderately juicy. Stone small and roundish. Ripens at Albany by the middle of August, and continues two weeks.
Originated in Dennison's garden, which has been rich in fine varieties.

9. AUTUMN GAGE.

Fruit of the medium size, ovate; base without a depression. Color pale yellow; bloom whitish. Flesh yellowish green, pleasant and sweet.
Originated in Newburgh, N. Y.

10. HUDSON GAGE.

This differs somewhat from the preceding, in having a depression at the base, and is faintly striped with greenish, and in ripening nearly three or four weeks earlier; and from the Imperial Gage, which it most resembles, but ripens at least three weeks in advance of it.

11. PRINCE'S YELLOW GAGE.

Fruit of the medium size, oval; suture marked with a line. Color golden yellow, white. Bloom conspicuous. Stem one inch long, set in a small depression. Flesh deep yellow, rich and sweet but not juicy. Ripens in August.
Originated in Flushing with Mr. Prince.

12. DRAP D'OR.

Mirabelle Grosse.

Fruit rather small, round; suture indistinct; apex indented. Color golden yellow, in the sun sometimes dotted with crimson. Flesh yellow, sweet, rich, but some portion adhering to the stone. Ripens the second week in August.

13. MIRABELLE.

Fruit quite small, obovate, with a distinct suture. Color yellow and spotted with red, and bearing a white bloom. Tree productive, but its fruit is ranked only as second-rate; used principally for preserves.

14. ENGLISH YELLOW GAGE.

Little Queen Claude.

Fruit small and round, with a distinct suture on one side. Color pale yellowish green, but becoming yellow in ripening, and sprinkled with reddish dots; bloom conspicuous; base slightly indented. Flesh yellowish, sweet and pleasant.

15. IMPERIAL OTTOMAN.

Fruit rather less than the medium size, oval; suture extending over ½ of one side of the apex. Color pale greenish yellow; marbled. Stem downy and slender, and only slightly sunk. Color dull yellow, clouded, and only thinly bloomed. Flesh juicy, sweet. Stone pointed. Ripens the last of July. Tree hardy and productive.

16. PRIMORDIUM.

Fruit less than the medium size; base subacute; suture distinct at the apex. Stem short and slender, downy. Color yellow; bloom thin. Flesh yellowish and only moderately juicy, sweetish. Ripens in July.

17. REINE CLAUDE DE BAVAY.

A new Belgium fruit of greenish yellow color, and spotted with red, and marked with violet colored longitudinal veins. Tree productive, bearing a rich sugary fruit. *Thomas.*

18. ST. MARTIN'S QUETSCHE.

Fruit of the medium size; of a pale yellow, with a white bloom, and sometimes spotted with brown. Excellent. Ripens middle of autumn. *Thomas.*

ORDER II. Flesh adherent to the stone.

19. BUEL'S FAVORITE.

Fruit of the full medium size, ovate, broadest at the base; suture distinct, extending half round the plum; slightly indented at the base. Stem $\frac{3}{4}$ of an inch long. Color pale green; base slightly dotted with red. Flesh greenish yellow, firm, juicy and high flavored. Stone pointed. Ripens in Albany the first of September, where it originated.

20. COE'S GOLDEN DROP.

Fruit above the medium size, oval, elongated or higher than wide, base narrow; suture distinct. Color light yellow, and in the sun may be dotted with red. Stem $\frac{3}{4}$ of an inch long. Flesh yellowish, rather firm, rich and sweet. Ripens late and hence may not succeed at the north.

21. HULING'S SUPERB.

Fruit above the medium size, round or nearly so; height and breadth equal; suture shallow. Stem one inch long, stout. Color greenish yellow, bloom distinct but pale. Flesh firm, flavor fine and high. Ripens late in summer. Tree moderately productive.

22. MULBERRY.

Fruit above the medium size, oval, symmetrical, tapering to a narrow base, without indentation, higher than wide. Color yellow, slightly crimsoned near the acute base; bloom filmy. Stem rather short and slender. Flesh greenish yellow, coarseish, but rather rich. Ripens the first of autumn. Originated in Albany, N. Y.

23. WHITE EGG PLUM.

White Magnum Bonum.

Fruit above the medium size, oval; base narrowed, but obtuse aud without a neck, and only slightly indented; suture distinct. Bloom filmy and white. Color light yellow. Flesh firm, rather coarse, and subacid, but becomes sweeter on being fully ripe; used for preserves. Ripens at the beginning of autumn. There are evidently several subvarieties differing both in size and color, as well as in flavor and acidity.

24. LUSCOMBE'S NONSUCH.

Fruit of the medium size, roundish. Color yellowish green, and bloomed with yellow orange; suture wide; taste subacid, mingled with sweet. Less valuable than the Green Gage.

25. ST. CATHARINE.

Fruit of the medium size, obovate. Color pale yellow, sometimes tinged reddish in the sun. Stem slender, base scarcely indented. Flesh juicy and fine flavored.

26. WHITE PERDRIGON.

Fruit of the medium size, oval, narrowed at the base. Color pale green; white and red dots in the sun. Qualities of this plum are not so valuable as the Green Gage, yet it is quite fine.

27. DAMSON.

Fruit small, ovate, narrow at base, and without indentation. Color pale yellow, dotted with reddish brown. Ripens late. Tree productive: and fine for preserves.

Class II. *Fruit red, purple or blue.*

Order I. Flesh free.

28. COLUMBIA.

Fruit very large, round, wider than high; base broad, with a shallow depression; slightly unsymmetrical. Color brownish purple, dotted with fawn or pale colored dots and distinctly bloomed. Flesh yellowish red, juicy, sugary and excellent when ripe. Regarded as one of the noblest of the dark colored plums.

29. DIAMOND.

Fruit above the medium size, oval; base slightly indented, receiving a stem $\frac{3}{4}$ of an inch long. Color black. Flesh rather coarse, and wanting in juice, acid. Tree productive. Only used for cooking.

30. RED DIAPER.

Fruit large, obovate, narrowed at base. Color reddish purple, bloomed with light blue. Stem $\frac{3}{4}$ of an inch long; slender. Flesh pale green, juicy and rather rich; quality medium.

31. RED MAGNUM BONUM.

Purple Egg. Imperial. Florence.

Fruit large, oval or egg shaped, narrow at base, unsymmetrical. Color pale red, dotted in the sun and deeper colored. Stem long and slender. Flesh greenish, firm and rather coarse. Branches smooth. Fruit used for cooking and preserves.

32. RED PERDRIGON.

Fruit of the medium size, roundish and slightly oval. Color deep red when ripe, and dotted with fawn colored specks. Stem one inch long, and rather stout, set in a small cavity. Flesh yellow, sweet and juicy. Ripens last of August, and remains till the middle of September.

33. RED GAGE.

Fruit about the medium size, oval, symmetrical; broader towards the base, without indentation. Stem short and rather stout. Color nearly of a brick red, slightly bloomed. Flesh greenish, juicy, sweet and fine. Ripens the middle of August.
Originated at Flushing.

34. PEACH PLUM.

Fruit much above the medium size, oblong, unsymmetrical, wider than high; base broadly indented. Stem short and stout; suture distinct, shallow. Color light red and brownish. Flesh rather coarse, but juicy and sprightly. It does not rank with the best fruits, but is esteemed for its appearance.

35. COE'S LATE RED.

Fruit of the medium size, round; narrow at the base and slightly indented; suture distinct at the apex, dividing the plum into two equal parts. Color light purplish red, with a brown bloom. Flesh rich and vinous. Late but productive.

36. DENNISON'S RED.

Fruit rather above the medium size, oval, and narrowed at the base; suture passing half round. Color fine light red; bloom filmy. Stem long and slender, and but little sunk. Flesh reddish and rather rich. Regarded by Thomas as second-rate. Origin Albany.

37. GERMAN PLUM.

Fruit rather large or slightly above the medium size, elongated, swollen on one side, tapering to the base; without indentation; suture distinct. Color purple, with a thick blue bloom. Stem slender. Used for drying. Late.

38. PURPLE GAGE.

Fruit of the medium size, roundish; suture shallow. Color purple, and bloomed with light blue. Stem long. Flesh greenish yellow, sugary and of a fine flavor. Stone compressed. Excellent.

39. EARLY ROYAL.

Fruit of the medium size, roundish; base indented. Stem rather short and thick; suture shallow. Flesh amber colored. Early.

40. ROYAL.

Fruit of the medium size; widest at the apex, and marked with a suture; base scarcely indented. Stem long and rather slender. Color reddish purple, thickly bloomed, Flesh dull yellow, rich and juicy. Ripens the first of autumn.

41. BLUE GAGE.

Fruit small, round. Color dark blue, bloom light blue. Flesh juicy, greenish, subacid. Tree productive.

42. SCHENECTADY CATHARINE.

Fruit of the medium size, roundish, and slightly narrowed at the apex; suture shallow. Color deep purple, violet. Stem slender, inserted in a deep narrow depression. Flesh greenish yellow, melting, sweet and juicy. Excellent, equal, in the opinion of some, to the Green Gage.

43. HOWELL'S EARLY.

Fruit rather less than the medium size, oval. Color light brown, with a blue filmy bloom, often lighter in the shade, or greenish yellow. Stem $\frac{3}{4}$ of an inch long, slender. Flesh amber colored, sweet and juicy. Early. Originated in New-York.

44. EARLY ORLEANS.

Fruit of the medium size, round, oval; suture shallow. Stem rather short and thick. Indented at the base. Color reddish purple. Flesh yellowish green. Early.

ORDER II. Flesh adhering to the stone.

45. BREVOORT'S PURPLE.

Fruit large, oval; at the base the suture is distinct. Color reddish purple, covered with a filmy violet bloom; base rather deeply indented. Flesh yellowish, soft, juicy, subacid, with a vinous flavor. Ripens the first of September.

Originated with HENRY BREVOORT, Esq. of New-York, from the Washington, planted in 1849. *Downing.*

46. BLUE IMPERATRICE.

Fruit of the medium size, obovate, and tapering to the base, which is obtuse and slightly indented. Stem rather less than an inch long. Color deep purple; bloom blue, quite thick. Flesh greenish yellow, rather dry, rich, sugary. Ripens in October, and continues till into November.

47. BLUE PERDRIGON.

Fruit of the medium size, oval; narrowing towards the base; indentation small. Color reddish, and passing into purple, and dotted brown; bloom whitish. Flesh greenish yellow; firm and sweet.

48. BLEECKER'S SCARLET.

Lombard.

Fruit of the medium size, and greater, roundish, oval; base rather broad, indented, symmetrical; suture indistinct. Color reddish violet. Stem slender. Flesh yellow, when ripe, rich and pleasant. Ripens the last of August.

49. FROST GAGE.

Fruit rather small, round, oval; base indented. Color deep purple. Flesh juicy, high flavored, and becoming sweet. Tree productive and very hardy.

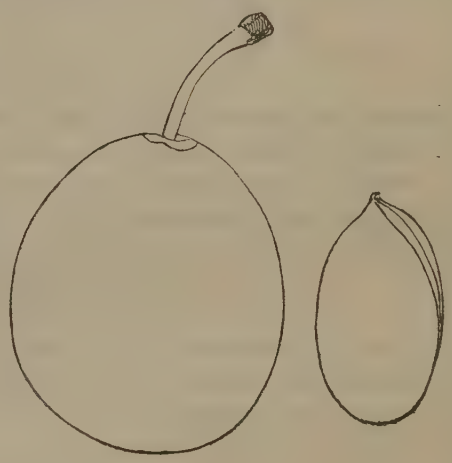
50. DOMINIE DULL.

Fruit of the medium size, elongated, oval; suture obscure; indentation obscure. Color dark purple, overcast with a blue bloom. Flesh juicy, rich, but becomes dry in ripening. Tree productive. Originated in Kingston, N. Y.

51. ICKWORTH IMPERATRICE.

Fruit of the medium size, and purple, sweet and rich. Valuable for its lateness or winter keeping.

52. QUACKENBUSH PLUM. Fig. 2.



This plum is large and fine, and highly esteemed in Albany, though it is less fine than the Schenectady Catharine.

CHAPTER VII.

THE CHERRY.

DESCRIPTION OF SOME OF THE VARIETIES OF CHERRIES WHICH ARE WORTHY OF CULTIVATION.

Class I. *Form heart shaped.*

A. Fruit purple or nearly black.

1. BLACK EAGLE.*

Fruit rather large, obscurely heart-shaped, with an obtuse apex, and slightly indented base. Color nearly black, with a dark crimson flush, and usually fine rich flavor. Ripens the first of August.

2. BLACK TARTARIAN. Plate 63.

Fruit of the largest size, compressed and heart-shaped; rather wider than high, or height and breadth subequal. Stem 1½ inch long, inserted into a broadly indented base. Color black or nearly so, glossy; surface uneven. Flesh dark, rich, inclined to sweet. Ripens by the middle of June. Tree vigorous and productive.

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* Pomologists divide the cherry into four classes.

I. Heart Cherries, whose color is mostly black. The trees grow rapidly, and form ample and lofty heads, and are adorned with broad green leaves.

II. The Bigarreaus whose surfaces are somewhat mottled, and whose flesh is firm. The growth and foliage of the trees is similar to the former class.

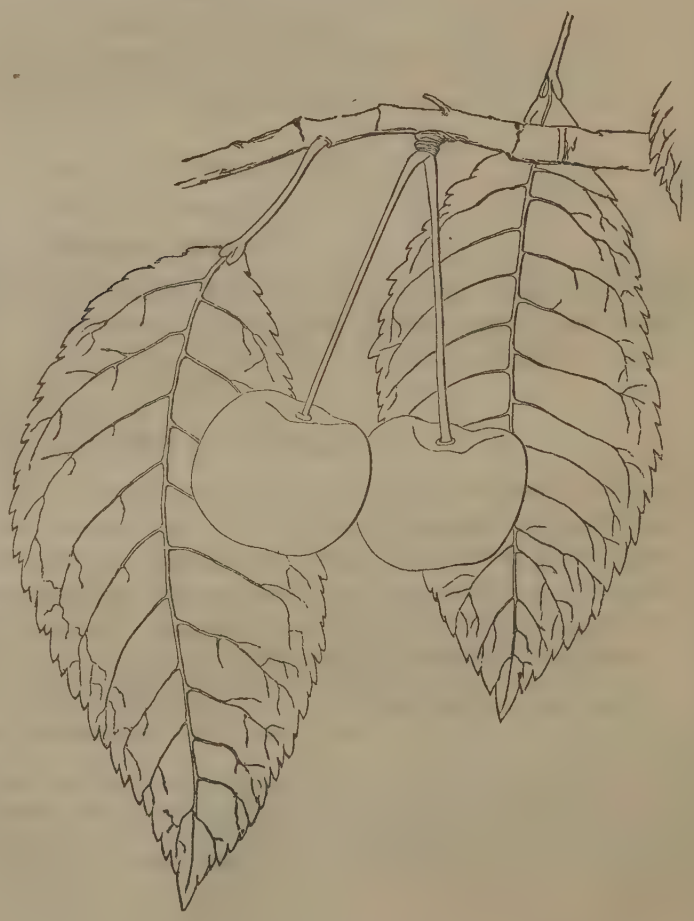
III. Duke Cherries, the form of whose fruit is more rounded, and their flesh more melting. The trees are less vigorous in their growth, and do not attain the height of the two former classes. They form lower heads.

IV. Morello Cherries whose fruit is also rounded, but when ripe more or less acid. The trees form low, spreading heads with small wiry branches, and narrow dark colored leaves. The fruit is not esteemed for the desert, but is used principally for preserving.

3. KNIGHT'S EARLY BLACK.

Fruit large, or of the largest description, considerably wider than high; base indented; indentation less broad than in the Black Tartarian, and deeper. Color black; surface uneven. Flesh dark crimson; tender and juicy. The proportion in height and width differ from the Black Tartarian, as well as in the depth and width of the indentation, and from the Black Eagle in being proportionally narrower towards the apex. Ripens about the second week in June.

4. WENDELL'S MOTTLED BIGARREAU. Fig. 1.



Fruit of the medium size, or larger, obtuse heart-shaped; wider than high, base indented. Color dark red when ripe, and faintly mottled with lighter. Stem of a medium length. Flesh firm, crisp, high flavored. Tree of a vigorous growth. Originated with Dr. Herman Wendell, Albany, and first described in the American Journal of Agriculture.

5. EARLY PURPLE GUIGNE.

Fruit about the medium size, roundish and obscurely heart-shaped; height and breadth equal. Stem quite long, two inches. Nearly black when ripe, or purple, and dotted during its ripening, or changing from dark red to black. Flesh dark. Ripens the last of May.

6. MAY BIGARREAU.

Fruit rather less than the medium size, roundish; breadth greater than the height; indentation shallow. Stem long. Black when ripe. Flesh deep crimson, juicy, inclined to sweet. Ripens the last of May.

B. Fruit red, light or deep red.

7. DOWNTON.

Fruit of the largest size; heart-shaped or deeply indented at the base, wider than high; base wider than the middle; apex slightly indented. Stem long, nearly two inches, slender. Color yellowish, and stained with red. Flesh yellowish, tender, rich.

8. DOWNER'S LATE.

Fruit of the medium size, wide, ovate, wider than high, obscurely heart-shaped, indented. Stem of a medium length, and rather stout. Color yellowish red. Fruit in clusters. Flesh tender, melting, rich. Late.

9. EARLY WHITE HEART.

Fruit of the medium size, obscurely heart-shaped; height and breadth subequal; base indented. Stem rather long. Color yellowish, tinged and spotted with pale red. Flesh rather firm, sweet and pleasant. Early.

10. COE'S TRANSPARENT.

Fruit of the medium size, or larger, symmetrical, wider than high; base regularly indented. Stem slender. Color pale amber, blotched with deeper red in ripening. The fruit is regarded as prime. Ripens early.

11. WHITE BIGARREAU.

White Oxheart.

Fruit large, heart-shaped, surface irregular or uneven; wider than high. Color yellowish becoming marbled with red. Flesh firm. Ripens the last of June.

12. FLESH-COLORED BIGARREAU.

Fruit of the largest size, elongated; height and breadth equal or subequal; base regularly indented. Yellow and marbled with red. Ripens the last of June.

13. ELLIOTT'S FAVORITE.

Fig. 2.

Fruit of the medium size, or rather less, rounded; width greater than the height; symmetrical, slightly compressed. Amber colored and marbled with red. Stem slender. Flesh tender and delicate, juicy, sweet, with a fine flavor. Originated in Cleveland, Ohio.

14. THE DOCTOR.

Fig. 3

Fruit of the medium size, heart-shaped; base rather deeply indented; apex dimpled. Color light yellow. Flesh white, tender, juicy and sweet. Early. Originated in Cleveland, Ohio.

15. BIGARREAU OR GRAFFION.

Fruit of the largest size, much wider than high; base wide and indented, symmetrical. Stem rather thick. Color waxen yellow, with a red cheek in the sun. Flesh firm, fine and well flavored. Ripens the last of June.

16. ROCKPORT BIGARREAU.

Fig. 4.

Fruit of the largest class, heart-shaped; base wide and deeply indented; apex dimpled; width much greater than the height. Color red, with pale amber in spots. Flesh firm and juicy, sweet and rich, and finely flavored.

Originated with Dr. KIRTLAND, Cleveland, Ohio.

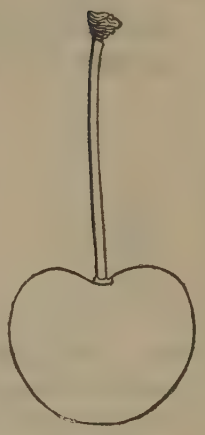
17. OHIO BEAUTY.

Fig. 5.

Fruit of the largest class, heart-shaped, wider than high, and wide at base, which is broadly and deeply indented; apex rounded, without a dimple. Stem long and rather stout. Color pale red, and deepened and marbled with red. Flesh white, tender and finely flavored. Cleveland, Ohio.

18. KIRTLAND MARY.

Fig. 6.



Fruit quite large, round, heart-shaped, symmetrical; base rather deeply indented; apex rounded and narrower than the base, widest in the middle. Color marbled with light and deep red; ground yellow. Stem of a medium length. Flesh light yellow, half tender, rich and sweet; high flavored. Cleveland, Ohio.

19. CLEVELAND BIGARREAU.

Fig. 7.

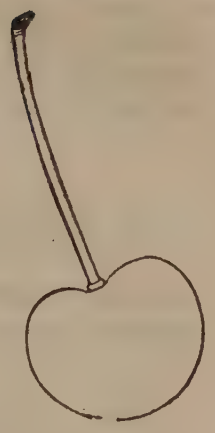
Very large, heart-shaped; height and breadth subequal; wide towards the apex, which is very obtuse or rounded; base with a shallow and wide indentation. Stem comparatively short; suture broad and deep. Color clear red or amber yellow. Flesh firm, juicy, very rich. Ripens early. Origin, Cleveland, Ohio.

20. NAPOLEON BIGARREAU.

Fruit large, regularly heart-shaped. Skin pale yellow and amber, shaded with deep red. Stem short. Flesh firm, flavor scarcely equalling the first-rate, according to Thomas.

21. LATE BIGARREAU.

Fig. 8.



Fruit rather larger than the medium size, heart-form; base indented; apex rounded, wider than high. Stem of the medium length. Color pale red or amber. Flesh fine, juicy and rather late in ripening. Cleveland, Ohio.

22. ELTON.

Fruit large, heart-shaped, elongated; height and breadth equal; base indented, apex pointed. Stem two inches long. Color pale yellow, and shaded with red. Flesh firm, sweet and juicy, high flavored and excellent. English.

23. HOLLAND BIGARREAU.

This cherry resembles closely, in form, the Elton. Surface whitish in the shade, and mottled with red on the sunny side. Flesh tender and juicy, and highly flavored. Ripens a little later than the Elton.

Class II. *Duke Cherries, form round.*

A. Color dark or purple.

24. ARCH DUKE.

Fruit very large, round, heart-shaped. Color dark glossy red, nearly black. Flesh light red, taste when ripe subacid, finely flavored. Ripens at mid-summer.

25. MAY DUKE.

Large, roundish, heart-shaped. Color when ripe, nearly black. Flesh dark purple; juicy and melting, rich, subacid, and finely flavored. Ripens early.

26. BELLE DE CHOISY.

Fruit rather large and roundish; base with a shallow indentation. Skin thin and netted beneath, or with veiny texture. Color carnelian red, when exposed to the sun. Flesh amber-colored, tender and melting. Stem rather short and stout. Ripens the middle of June. It is an old French variety, and may be regarded as one of the first in its class.

Class IV. *Morello.*

27. BELLE MAGNIFIQUE.

Fruit large, round. Color light red, mottled with darker spots; acid, juicy. Ripens between the middle and last of July. For preserving.

28. MORELLO.

Fruit rather large, roundish; breadth greater than the height; apex rounded. Color red, and becoming, when fully ripe, quite dark. Flesh purplish red, juicy and tender, sub-acid. Ripens the latter half of July.

CHAPTER VIII.

THE GRAPE.

DESCRIPTION OF SOME OF THE MOST VALUABLE VARIETIES OF GRAPES.

I. NATIVE GRAPES.

1. CATAWBA.

Fig. 1.

Color pale red, slightly tinged with purple, or brown; bloom filmy and of a lilac tinge; nearly round. Flesh pulpy, juicy, sweet and slightly aromatic and musky. Ripens well in Albany, especially if only slightly sheltered.

2. ISABELLA.

Fruit dark purplish, or black, bluish black; bloom blue and rather heavy; oval or roundish oval, larger than the Catawba. Skin rather tender. Flesh sweet, juicy and slightly musky. Ripens farther north than the Catawba.

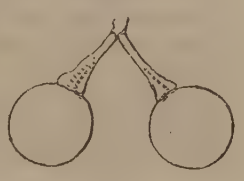
The Catawba and Isabella are the most profitable grapes for culture in this latitude being sufficiently hardy to ripen perfectly; and being also of excellent qualities, and not much subject to the blight or mildew.

3. LENOIR.

This variety bears large compact bunches, with berries smaller than the Catawba. Skin thin and colored with dark purple, and bloomed thinly. Sweet and excellent. The wood is long-jointed, bearing a three lobed leaf.

4. OHIO.

Fig. 2.



The fruit of this grape grows in rather large but not compact bunches. This grape, so far as it has fallen under my observation, is scarcely worth cultivating here. There is a wild one growing on the limestone hills about Schoharie, which closely resembles this grape; better if anything.

5. FOX GRAPE.

Scuppernong.

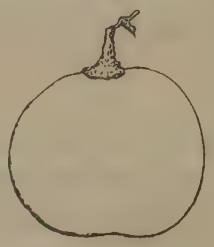
This grape is a southern species, and known as the *Vitis Vulpina*. The bunches bear about a dozen thick-skinned berries, and larger than the Isabella, and round. Flesh acid near the seeds, and rather disagreeably musky; but the perfume is fine and pleasant. It grows well in Maryland near Baltimore, and with protection, or laying down would succeed well here.

II. FOREIGN GRAPES.

A. Color dark red, purple and black.

6. BLACK HAMBURGH.

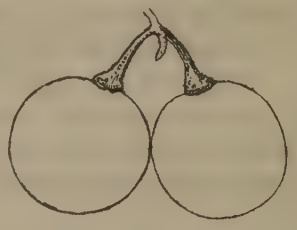
Fig. 3.



Fruit large, wider than high, and growing in clusters shouldered on both sides. Color when ripe, black. Flesh sugary and rich. The vine bears well in the house, and sheltered, but does not ripen in the open air.

7. BLACK PRINCE.

Fig. 4.



Fruit of the medium size, round, or slightly oval, growing in long thinly set clusters. Skin tough and thick, and thickly covered with a blue bloom. Flavor sweet and excellent. Rarely ripens in the open air.

8. BLACK MOROCCO.

Fig. 5.

Fruit large, oval, higher than wide, or elongated. Reddish purple, and running into black. Flesh green, seeds green and large; taste slightly acid, though rich. Grows in large clusters, the berries of which have a thick skin. Downing remarks that it requires to be fertilized by the pollen of the Black Hamburgh, or some other hardy sort;* that it is late in ripening, and requires for this end a good deal of heat.

*It is difficult to understand why it is essential to the ripening or perfection of a fruit of the grape kind, that it should be fertilized by the pollen of another variety. The pollen can have no influence, except upon the seed. The pollen of an apple blossom, falling upon the stigma of another variety of apple, will not have the least influence in

9. BLACK ST. PETER'S. *Thomson.*

Fig. 6.

Fruit of the medium size, roundish oval. Skin thin. Color black. Fine and excellent. Regarded by Downing as one of the best sorts for a vinery without heat.

10. BLACK LOMBARDY.

Fig. 7.

Fruit full medium size, slightly oval, or higher than wide. Seeds large. Flesh sweet near the skin. Clusters large.

11. RED CHASSELAS.

Fig. 8.

Fruit of the medium size, round; reddish, transparent and sweet. Seeds four.

12. GRIZZLY FRONTIGNAN.

Grey Muscat.

Fig. 9

Fruit about the medium size, oval; reddish gray, with a thick bloom; juicy and rich, musky.

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changing the character of the fruit. The seed, however, would produce a variety of apple differing from that produced by the tree upon which the pollen fell. In the Indian corn, and in all the cereals, the kernels or grain will be changed, or a new variety will be the result. In the one case, the fruit is derived from the cellular system of the vegetable; in the other, that of the cereals, the fruit belongs to the reproductive. These remarks are not designed to invalidate the truth of the remarks of Mr. Downing, for it may be that in order to obtain a sufficient activity of the vessels belonging to the cellular system of the grape, it may be necessary that those connected with the reproductive should be brought into full action by the influence of the pollen of a more vigorous kind, although I am unable to satisfy myself of the real grounds upon which the practice is founded.

13. MILLER'S BURGUNDY.

Le Meunier.

This grape grows in short bunches, with the berries closely set; roundish oval. Color black with a bloom of blue. Its flesh is tender, and the vine sufficiently hardy to ripen in the western part of the State in the open air; but had better be laid down as a more abundant and better fruit will be obtained. Leaves downy beneath.

14. ESPERIONE.

Turner's Black.

It grows in large shouldered clusters, with berries rounded and slightly flattened. Color purple. The skin is covered with a thick blue bloom. Flesh pleasant, adhering to the skin. Wanting in richness, but is hardy and prolific, and ripens in the open air.

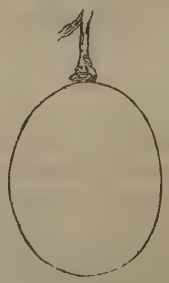
B. Color white, greenish white, and green.

15. CHINCHE GRAPE. Fig. 10.

Fruit large, ovate, thicker at the base than apex; elongated. Green, translucent. Flesh fine, sweet.

Exhibited under this name at the Buffalo Convention, 1848. Probably a variety of White Muscat.

16. WHITE MUSCAT. Fig. 11.



Fruit large, elongated, oval; ends nearly equal, though the apex is slightly wider than the base. Green, translucent. Skin very thin. Flesh perfumed, musky, sweet. Three seeds. October.

17. ROYAL MUSCADINE.

Fig. 12.

Fruit of the medium size, round, or only slightly oval; apex slightly widened. Green, translucent. Skin firm, and slightly astringent. It grows in large and long bunches. Flavor fine and rich; liable to fall early, and sometimes cracks.

18. SWEET WATER.

Fig. 13.

Fruit below the medium size, round; grows in medium sized bunches, with the berries hanging rather loosely. Skin thin, white or yellowish green. Ripens earlier than the former; but of an inferior quality.

19. WHITE FRONTIGNAN.

Fig. 14.

Fruit full medium size, round, and set thick upon the stem. Color white, or yellowish white. Skin thin and bloomed. Flesh slightly acid, tender, rich, perfumed; flavor musky. It is an esteemed variety, and has been cultivated very generally.

20. MUSCAT BLANC HATIF.

Fruit of the medium size, slightly oval; base narrowed. Color green, opake. Skin tough. Flesh finely flavored. Seeds often four.

CHAPTER IX.

GOOSEBERIES.

The native species of gooseberry has never been cultivated with sufficient care in this country to improve materially its qualities: most of the plants of this kind of fruit are of foreign origin. We have, however, some kinds which it is probable may yet become important to the gardener. A white variety I have seen growing quite abundantly in Essex county, N. Y., and without prickles; is quite sweet and of a fine flavor. It bears only a small berry, but they are quite numerous upon the bush. The gooseberry when properly cultivated is productive and profitable. It is subject to the mildew, which is a drawback upon its value. It is, however, stated in the numerous periodicals of the day, that salt meadow hay, placed beneath and upon the bushes, so as to shade them partially, is quite effective in its prevention. Or as a substitute therefor, straw wet in salt water will answer nearly the same purpose. It is probable, however, that a mixture of common salt and sulphate of soda, Glauber salts, may be still more effective in the prevention of mildew.

DESCRIPTION OF SOME OF THE MOST IMPORTANT VARIETIES.

1. WOODWARD'S WHITESMITH. Plate 59, fig. 3.

Fruit rather large, oval, or round oval; veiny and downy, translucent. Green and greenish yellow, and whitish. The quality of the White Smith places it in the first class. The branches are erect.

2. CHAMPION. Plate 59, fig. 1.

Fruit large, round, translucent; large, veiny. Skin smooth. Color green.

3. EDWARD'S JOLLY TAR. Plate 59, fig. 2.

Fruit large, oval or roundish oval. Skin smooth. Color green; flavor fine; branches drooping.

4. WAINMAN'S GREEN OCEAN. Plate 59, fig. 4.

Fruit large, elongated, widened at the apex, and narrow towards the base. Skin smooth. Color green, flavor rather better than second-rate. Branches drooping.

5. WHITE EAGLE. Plate 59, fig. 5.

Fruit large, ovate, smooth. Color greenish white. Flavor first-rate. Branches erect.

6. SULPHUR YELLOW. Plate 60, fig. 1.

Fruit about the medium size, hairy, ovate. Color yellow.

7. CHAMPAIGNE. Plate 60, fig. 2.

Fruit below the medium size, round. Skin hairy. Color purplish red. Branches upright.

8. FARROW'S ROARING LION.

Fruit large, oblong, smooth. Color dark purplish red. Flavor excellent. Branches drooping.

9. PITMASTON'S GREEN. Plate 60, fig. 4.

Fruit very large, elongated, ends subequal, rather pointed at the insertion of the pedicle. Color green, purplish at the apex. Flavor fine.

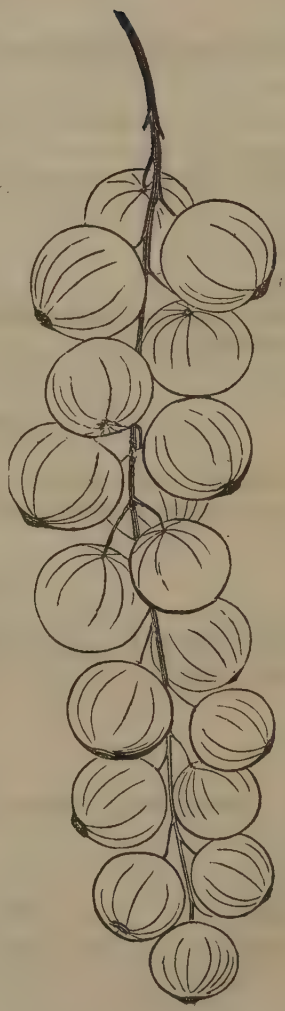
10. GREEN WALNUT. Plate 60, fig. 5.

Fruit rather large, ovate, rather elongated at the apex. Color green. Smooth. Flavor first-rate.

CHAPTER X.

THE CURRANT.

Fig. 1.



1. RED DUTCH. PLATE 76.

Fruit large or nearly twice the size of the common currant. Red. Cluster long and large; fine and sweeter than the common currant.

2. WHITE DUTCH. PLATE 76.

Fruit large, equalling in size the foregoing variety. Color yellow; translucent. Fine.

3. MAY'S VICTORIA. Fig. 1.

Fruit large; white. Cluster long and heavily laden with berries; rather acid, and late in ripening.

4. CHAMPAIGNE. PLATE 76.

Fruit large. Color pale pink or rose; intermediate between the Red and White Dutch.

5. BLACK NAPLES. PLATE 76.

Fruit large. Color black. Clusters large and fine. Early.

6. CHERRY CURRANT.

Very large, larger than the common Red Dutch. Color light red; racemes rather short. Fruit rather acid; growth large and luxuriant; but less productive than the common currant. New. *J. J. Thomas.*

CHAPTER XI.

THE RASPBERRY.

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1. RED ANTWERP. Plate 62.

Fruit large; conical, and hairy when green, base rather wide. Color dull red; flavor rich and sweet.

2. YELLOW ANTWERP. Plate 61.

Fruit large, conical; hairy before maturity. Color yellowish; tender, soft, very rich; less hardy than the Red Antwerp.

3. FRANCONIA.

Very large, rather firm; roundish, conical. Color dark red; flavor rich subacid; productive. Canes vigorous and hardy.

4. THE WILDER RASPBERRY. (*Cushing.*)

Col. Wilder.

Fruit very large, roundish, conical, cream colored; semitransparent. Flavor fine; growth vigorous, quite hardy; productive and ripening early, and continuing for several successive weeks. New. Raised by Dr. Brinckle, of Philadelphia, from the seed of the Fastolff. *J. J. Thomas.*

5. FASTOLFF.

Large, conical, obtuse, and somewhat rounded. Color purplish red. Flavor rich. Growth vigorous and branching; hardy and productive.

CHAPTER XII.

THEORETICAL AND PRACTICAL HUSBANDRY.

GENERAL REMARKS.

A PRODUCTIVE agriculture is founded upon observation. True as this assertion is, it is no doubt equally true that many have been led into error and the practice of an unproductive husbandry by observation also. This seeming paradox is easily explained. It arises from having given importance to accidental phenomena, or those phenomena which are of little or no consequence to the result. As an illustration of the correctness of this position I may refer to the confidence which many agriculturists reposed in a special electrical influence, which was supposed to promote the growth of vegetables, and which, by certain arrangements of conductors and non-conductors of the fluid, gave force to the assimilative powers of the plant. To follow up the idea, I may conceive that the general impression being that electricity is an agent of great importance in the economy of the earth, and perhaps of special importance too, in the organic kingdom, gave to the common mind a predisposing bias in its favor; hence trivial and unimportant observations, unconnected with the results, were seized upon as demonstrations of a principle. When, however, this notion that electricity, specially applied to fields of growing vegetables, is subjected to another class of observations it is found fallacious, notwithstanding its supporters appealed to facts for the truth of their doctrine. This is but a single instance of an erroneous practice founded upon observation. Without citing the numerous instances belonging to the same class, I proceed to remark, that it is apparent that the most important of all acquirements of the farmer, is to be able to distinguish between the accidental circumstances and those which are essential to the result; those which are important to the success of an experiment and those which have no influence upon it. The inability to do this, and the inattention which has been paid to it has given rise to most of the erroneous doctrines which have been propagated in this and every other country. It is true that it is not always an easy matter to do this; but it is equally true that error propagated is not by any means due to the difficulty, but rather to a hasty determination and an unwillingness to consider the

facts in detail. There are two additional reasons; a preconceived opinion almost independent of any fact, and a wish to advance something new and striking, something novel to the common mind. These two reasons are, perhaps, as prolific of error as utter ignorance; there is far less expectation of correcting errors originating in the weakness and vanity of men than those which arise from difficulties which belong to the subject. Those errors which arise from defective observation and a want of power to discriminate between the essential and accidental, may be corrected by education. That course of education which bears as a corrective upon such faults is one which embraces a full and thorough study of the characters of matter and of the phenomena of organized things; those which are due to chemical change, as well as those which are due to, and modified by meteorological conditions. Sunlight and shade, rain, dew and drought, winds and calms, heat and cold, all have their influence upon the constructive atoms of organized matter, and all the phenomena which accompany such changes must be noted with a direct reference to their influence upon living beings. To succeed as an observer it is necessary that the observing powers should be highly cultivated; that they should be educated. There is no fact probably more striking than the ability which is acquired of distinguishing counterfeit money. Clerks in mercantile establishments often acquire the power of detecting a spurious bill at a glance: they see a suspicious look without an effort; they have created as it were a new sense; and hence, what is nearly undistinguishable to other men is apparent to them. This result, however, of seeing simply what is, or what is not, belongs to the lower grade of acquirements, and yet is of the utmost importance. To complete the development of those faculties which are necessary to form a complete husbandman requires the deductive or inductive powers; to make philosophical deductions from phenomena is the highest result of the educated sense and the educated mind. It is of no use for a man to see, unless he can reason; and it is no use to reason unless he can see; and in proportion as both the outward and inner senses are perfected, in the same proportion will the individual take his grade or standing. A great majority of men, however, see without reasoning, and reason without seeing, and hence it is not strange that error in agriculture, in the bearing and relation of phenomena, and in political economy, as well as religion, is so common.

A perfected agriculture can result only from nice adjustments; a determination of the nature of the matter to be dealt with, and its inherent forces, combined with a special knowledge of the individual organization and its functional endowments and functional wants. Defective products are mainly due to functional wants: there are no truly diseased products or disorganized organs. Graduate the supplies to the nutrient powers, satisfy the capacities of the plant at the proper time, and all other things being adjusted the husbandry is perfect: or give the plant its climate, temper the heat and moisture to its constitution, make its physical condition happy, and put within its reach the assimilating elements, and enough is done to insure productive returns. But to do this requires probably more knowledge of soils, and of the cultivated vegetables, than we now possess. The object is

to supply without waste, to cheapen the product by the expenditure of the least labor, and restricting the food to the kind and quantity, so that it shall not be lost by escaping into the air, or being washed to remote parts by rains. It is evident that adjustments require a complete insight into the physiology of vegetation—its incipient stage, its maturing strength, the peculiar or special products to be formed, the elements composing them, and the best form in which these elements should be combined to meet all the wants of the being. As I have already said, functional endowments must be considered; hence to pursue that course with a plant which will give it an early vigorous constitution, a full development of its organs in its first stages, and the foundation is laid for the full amount of the products sought.

The conditions required for a vigorous and healthy vegetation are quite various. As there are animals who feed upon the tobacco plant, poisonous mushrooms, the mucilaginous leaf, decaying wood, and the glutinous starchy cereal, so there are those who live in boreal regions, others under the tropical sun; some in clear, others in muddy waters, some in pestiferous marshes, some in dry and burning sands. The conditions of life, though they require a wide range, yet they are multifarious: to some, sunlight in its undecomposed form, is an essential circumstance to their perfect development; to others it is equally necessary that they should be stimulated only by the light modified by the green of the forest; the open and sunny day fades their colors and shrivels their organs, hence it would seem that these plants acquire their greenness by some other elements than by starch and chlorophyl. Our chemistry is here at fault; we know that the maize or Indian corn can not grow in the shade, even in diffused light; it pines under the green light of forest trees, and grows too feebly to reproduce itself: but the moss and lichen, even in the deep shade of the forest, where no direct light ever penetrates, flourish and develop themselves perfectly. This shows us that the economy of plants is not restricted as we have supposed. We can not say that all plants require sunlight, that it is only under the influence of it that they assimilate the elements. It shows us too that the study of conditions is of the utmost importance. Where do we see, under the natural influences, organic beings acquiring perfect development, and where do we see them pine? Is it light direct or light reflected from green bodies which they want! or do they require the damp wood or the dry forest? That condition in which we see development in the perfection of seed and fruit is the true one.

We must not, however, consider plants as fixed and determinate in their wants; they possess a flexibility of constitution which is often admirable. This fact, however, is more eminently so in some species than in others. Those most important to man as the indigenous or the cereals, have no doubt a more restricted range; they all require heat and light; some, as oats and barley, range widely as to latitude, and perfecting their seed in a few months. Rice, however, must germinate in flooded fields under a hot sun; its condition is restricted, while many marsh plants may be transported to the dry garden and flourish under the change. The side-saddle plant (*Sarracenia purpurea*) is a remarka-

ble instance of flexibility. Even the pine is not very fastidious as to position; the marsh, arid plain, each developing the individual to its greatest dimensions; but these are not very common instances, and when we come to consider the plants nutritious to the mammifera, we find they are bound under the law of conditions and speciality; and hence it is their speciality as to light and shade, heat and cold, dry and wet, and particularly as to nutriment, must be studied with care. We are not able, it is true, to command in all respects the required conditions; what we may do is to place them in the most favorable conditions which our means will admit; shading and lighting, so far as artificial obstruction is practicable, and drying a soil by deep draining is always possible, and frequently wetting the plant by irrigation is equally so. An interesting inquiry relative to the change of the product consequent upon a change of place, has been pursued to a limited extent. Plants acrid and poisonous, when grown in the marsh, become wholesome and nutritious food in the dry garden. The increase of certain elements, as gluten, starch and dextrine, in wheat and other cereals—such a result and special adaptations to secure a given result will constitute a refined agriculture in time. Change or modification of product by variable modes of cultivation, will increase the profits of labor; this result has a different aim than the mere development of the individual, though they can not be wholly disconnected: the changes of which I have been speaking, are of course limited; it is not possible to modify results so far as to compromise the integrity of the species. Indian corn as may be seen on referring to the analyses, is very variable in its composition: sweet corn owes its peculiarities to an excessive development of dextrine; its presence in an excessive quantity gives it the peculiarities so remarkable; shrivelling as if it had not ripened when it was gathered; but still it is Indian corn, though far removed from early Canadian corn. There is always a boundary, in which all the changes which a species can undergo, may be circumscribed; and however wide these boundaries are, they can not be said to stretch themselves within the paling of another species. Canada corn is as unlike another cereal, as Sweet or Tuscarora, or Calico corn, though the latter is very rich in starch; in each of these, oil, gluten, dextrine and starch varies. If it were possible to transmute species by change of product and variability of elements, we should see the possibility realized in the cultivated vegetables. It is under cultivation, that the freest scope is given to chemical and physical forces; where the conditions are the most favorable for aiding its escape from the bondage of type or cast, from the trammels imposed by a law of nature. We can discover, however, only the individual development which makes no advances towards a new specific development; and hence we may safely infer that though individual change is common, yet it goes not out so far as to inosculate with any existing form belonging to a different type; it is hedged in by impassible barriers.

The food of man, as it exists in the cereals and other vegetable products, has been developed in them in quantities far greater than they ever produced it in a state of nature. The cereals then exist in a forced or unnatural state, and hence in addition to the ordinary agents, as light, heat and moisture, the soil in which they have been made to grow,

has been supplied to a greater extent in the constructive elements of the seeds or grain; and hence, too, it is no doubt possible so to cultivate them that in time they would revert back to their original condition. However this may be, it is evident that the soil must be supplied with the proper food by the hand of man, if successive crops are expected. A rational system of agriculture is founded upon principles contained in the foregoing remarks, or to be more definite, we must know what the soil contains; we must know what the products of growth, and also what our manures contain, else we work in the dark, without system and without understanding; and we certainly should not realize the advantages of our position as rational farmers; we could not produce in the most advantageous manner, crops of vegetables at the least expense of money vested in labor and material. The highest attainment in the art of husbandry is to give to each plant that which it specially requires for a perfect development at the least cost.

OF FORCE.

The idea of force is a deduction from the phenomena of vegetables, or living bodies, in process of development. It might, perhaps, be worded differently, and then we should probably say, that it is an assumption made necessary by phenomena. It should not be regarded as a fiction; it is something which we are obliged to admit, though we know nothing of it, except from its effects. We speak familiarly of a vital force; we thereby give it a virtual quality. This mode of speech, this assignment of quality is not objectionable, inasmuch as we speak directly and without circumlocution: still many of the physiologists of the day regard this mode of expression as scientifically incorrect; they deny that force has the virtual quality which is implied in the expressions *vital force*, *living force*, or *vitality*. But force has quality; it is formative and directive; simple chemical force is confined to decomposition and combination; it can not build up, except geometrically; it can cluster molecules, perhaps, in the solids, but even here probably another force must be admitted, a force electrical, by which symmetry is secured. But the force of polarity and formative force, which is deduced from growing bodies, has no relationship to chemical or electrical forces. It is impossible, almost, to speak of the phenomena of organized beings without at the same time admitting their vitality. This, possibly, may have arisen from habit, from recognizing decided and unquestionable properties in all beings which are called living. Why is it that these beings grow up in definite forms? Why is it that a maple separates itself from the elm or beech? If each cell possesses merely a growing force which chemical action supplies, we might expect indefinite and irregular forms; but the cell force never fails in the maple or oak to produce its specific form, hence we may at least say that force has quality in itself; it has virtue also in it which forms and directs, in each individual kind: we call it life in vegetables and animals. What is to be guarded against is, endowing this force with intelligence; it is no more nor less intelligent than chemical force, and its attribute is no higher. We may have erred in tacitly giving

intelligence to life, or a quality analogous to it, by which it foresees what it should do. An erroneous view of forces has undoubtedly been propagated in consequence of the diversity which may be recognized in their phenomena: thus the æration of the black blood in the lungs has been regarded as due to vitality. The digestion of food is still more so; yet both processes may be instances of pure chemical action. The vitality of the apparatus, in these cases, is dwelt upon, and is undoubtedly the basis upon which the vital doctrine rests. But we may discard such a view, for it is not the vitality of the apparatus, but the properties of the bodies mingling together in the apparatus, which gives rise to the phenomena indicating the change they have undergone. We might as well say that the formation of ether, when alcohol and sulphuric acid are mixed, is due to the sides of the retort, as that food is digested in the stomach by virtue of organs, independent of the substance taken into it. The organs which contain fluids are destitute of power over the thing contained, except to confine and convey, just as much so as glass and copper tubes, and retorts and flasks. This may look too much like inorganic phenomena, although the inorganic stand in opposition to organic. The first certainly performs no function, while it is the peculiar property of the latter to exercise one; it is essentially functional and active, while the inorganic is inert and at rest. But it is not through the organ in its activeness that activity exists, or that force is manifested. The organ is not transformed as a whole; but transformations are going on in its minute parts, as the cell: it is not the force of the organ, any more than it is the force of the retort when transformations occur in it, but each integral cell has activity, and the sum total of these activities, is the measure of the activity of the organ.

As in chemistry there is a combining and an arranging force, termed polarity, so in organic bodies there is a formative and directive force, which has been called vital. The combining and formative forces are analogous to each other, and so are the polar and directive forces also analogous in their respective spheres.

Mulder says that function depends as much upon form as upon matter; that the acorn of the oak forms tannic acid, the capsule of the poppy, opium, notwithstanding they may grow upon the same soil and be nourished by the same elements. This common result is due to the form of the cell as well as to the matter of the cell, and hence it follows, according to Mulder, that form has force. This view seems to be sustained by the fact that each species has its peculiar cell, and its peculiar combination of cells. The embryo which is formed by the parent, has both the form of the cell, and the arrangement determined, before the forces which develop the future individual come into action. Here then is the origin of the power which individualizes the species. The parent can only produce its like; it forms the cell, combines and arranges the groups, and in the cell the directive force slumbers till called into action by heat and moisture. It may be said that the cell and its combinations in the embryo, in conjunction with the matter, can only develop the individual like the parent, though the activities are merely chemical and independent of a virtual force; that it is not philosophical to suppose each being is endowed with a specific

directive force, inasmuch as they would thus be multiplied exceedingly; but then it is just as unphilosophical to suppose, from all that we know of chemical combination, that there is any more in it than change of elements, and that there is no directive power by which organs can be developed, or form grow out of it. In the seed the first change in germination, as it is called, is chemical, it is only formative—the preparation of the elements; here the activities would cease were there no other force present: something must direct and arrange the new molecules into characteristic cells, or the development of the individual can not go on. Chemical force is confined to a single result, a new combination of elements; here this force ceases, except to repeat—its sphere is limited to the formation of products, and can not extend to the construction of organs, any more than in inorganic beings, where crystals, not organs, are produced. We have to suppose, in the formation of crystals, a force unlike that of chemical force; and it seems quite as necessary, in organic beings, to suppose also that something must be superadded to chemical force, to secure the development of an individual: hence I am unwilling to adopt the idea, that the development and growth of a body is due only to chemical force. The error has been in excluding chemical forces from organized beings, and refusing to admit this force in vegetable and animal bodies.

In all bodies there are at least three forces, a gravitating, a chemical, and an electrical force, which is also called polarity; no substance is destitute of them; the first belongs only to the mass, the two last belong to the molecules, and they slumber in the mass, but acquire activity by division. We see this fact illustrated in a bar of iron; chemical force slumbers in it; but divide it into its atoms, and its affinity for oxygen is energetic; a new product is formed, consisting now of two elements placed in juxtaposition; they can not penetrate each other, and we can not distinguish the form of the compound molecule, as it is too minute for the most powerful microscope, and yet the microscope reveals the form, of particles which are so small that four millions may lie in a cubic inch of space. We might probably divide each of those individuals into one hundred distinguishable parts, and yet we do not obtain the simple individual molecule, we see it yet in masses; the minuteness then of a single molecule is inconceivable, yet it is a body possessing extension and impenetrability, an upper and a lower side. Forces which slumber are capable of being aroused by heat, light and electricity; even the presence of a third body is sometimes influential in exciting the activity of the forces of bodies.

The distance through which chemical forces operate is imperceptible; this seems to follow from their extreme minuteness.

Another force should be recognized in many cases, as it differs essentially from those which have been noticed in the foregoing paragraphs. This is molecular force: it is action between molecules of the same kind. The change which results from it is simply aggregation of similar particles. If we mix carbonate of lime, silica and alumina, in extremely fine powders, with sufficient water to form a paste the lime particles will combine and form concretions, at different points, and will increase in size, in proportion to the quantity

of lime in the paste; septaria in argillaceous rocks is an example which is quite common in formations of this kind. These concretions are formed there by molecular attraction: it differs from chemical, inasmuch as the new mass is composed of one material, and without having undergone a change, except change of place.

Molecular force can not be regarded as a force which is influential in producing changes in organic bodies: this is prevented by the activities of the other forces; when, however, these are diminished, when the force of circulation is diminished by age, concretions of carbonate of lime are found about the large blood vessels and valves of the heart, which operate mechanically in deranging the movements of the apparatus. But these are accidents in the animal economy. Something similar to this takes place in vegetables when crystals are formed in the cellular tissue, the bark for instance. These crystals are called raphides by botanists, and are generated in the fluids, and finally crystallize out: they are quite insoluble, and hence remain unaffected by liquids which surround them. In this case, as in the concretion of lime in the vessels about the heart of aged persons, the crystals are foreign bodies, and have nothing to do with the functions of the plant. Molecular force is one of the general forces of inorganic matter, and must be coëxtensive with gravitation. It differs from cohesion. As a common product of many vegetables, it would seem that the formation of starch is the nearest approach to molecular force: but it is scarcely to be regarded as its product, inasmuch as it is still within the reach of the other forces of the plant, and may be transformed into wax and sugar; it is not, therefore, a crystallization like the *raphides*, nor a concretion like *Septaria* in mud deposits; it is a true secretion, and remains within the influence of the special forces of the plant.

The forces which are active in plants and animals may be said to reside in the cells; each cell is an organ, and in one view it may also be said to be an individual, as it performs all the functions of an individual; the materials which are changed come in contact only with the cell, and it is within this little organ that great results are brought about.

A single cell then produces gum or a grain of starch, not the compound organ, but the individual cell. A grain of wheat has no force in itself to form starch or gluten; a cell is first formed, and if the gluten and starch, and gum were dissolved out, the shape of the kernel would remain, and the kernel would be found to consist of many empty cells. The kernel or grain has no force which can produce starch: it would be assuming the existence of a force anterior to the existence of the being exercising it. The kind of force in operation in the tissues of plants and organs of animals is inferred from the phenomena we witness; and in all cases where the phenomena are different we have a right to infer a difference in the antecedent form: we have no other means of determining the nature of the forces. A magnet moves a bar of iron; sulphuric acid and ammonia combine; molecules of carbonate of lime, when diffused through a paste of other materials, unite and form masses: we give the first as a magnetic force, the second as a chemical force, and the third as a molecular force. Water rises in tubes when the bore is extremely small; it is called capillary attraction. Each example is characterized by peculiar phenomena, and

hence may be regarded as distinct in kind. There is no change of material in magnetic, molecular or capillary attraction. The two last, though quite analogous, yet seem to be distinct in kind.

It is difficult to conceive how the growth of a body takes place. We see, under the microscope, some of the stages of growth. Granules first appear in clusters, and it would seem that the formation of a single granule is the result of a chemical force: it is a molecular force, perhaps, which brings a number of these granules together; and here we observe a phenomenon like one which belongs to an organ, the production of a vesicle on one side, or in connexion with the cluster of granules. This vesicle becomes the cell; an individual capable of reproducing like cells with itself. If we suppose, then, in the spring, when the sap of a plant or tree accumulates between the bark and wood, a granule to be formed by a combination of elements, and then an aggregation of them by molecular force, an organ of the lowest capacity is formed, and we may suppose a larger of these organs is developed. In process of time this larger becomes the annual ring of wood. Endogenous stems grow by the formation of wood upon the outside. But whatever kind of growth it may be, the phenomena are the same, the granule precedes the cell; and thus granules may be formed at the extremity of the axis of a plant, and thereby lengthen it; or it may appear at points on the side of the axis of growth, and thereby extend the branches horizontally; or between the bark and wood, and thereby increase the diameter of the trunk; the process is the same, but the different results depend upon the position of the growing points.

It is instructive to inspect the form and combination of cells under the microscope. The species of plants have their peculiar cells and arrangements. Even the species of the oak, as numerous as they are, furnish differences by which the species may be determined. Certainly, when the oak, elm, chestnut and beech are compared, or the members composing different families, the differences are too great to be overlooked. The separate and distinct products are connected of course with these differences in the form and arrangement of cells; and I may recur to the maxim of Mulder, that form is the parent of change as well as matter; that it is a true force. Function is, therefore, connected with form and arrangement; matter, form and function must therefore be considered in connexion, and they can not be separated from each other. As an illustration of the differences in the form of cells, and of their arrangements, I may refer to numerous plates in the second volume of the Agriculture of New-York. The resemblance of cells and combinations are much closer in the corniferous stems than in the other families of trees. So, as we approach the cellulares, the similarity increases; and yet, even in cellular plants, in their structure there is room for great diversity in form, size and arrangement, by which products of dissimilar kinds may be produced. Two kinds of stimuli are required to excite or awaken the force in seed or buds: heat and moisture are necessary to effect the first transformations, which are simply chemical, really simple results, but these precede a series more complicated, when the directive force begins the arrangement of molecules of the fabric to be constructed.

It is difficult to determine the influence of light on vegetables: it has been considered that its influence was necessary to fix carbon; or in other words, change the crude sap and render it fit for the nourishment of the plant. Potatoes and many other bodies receive accessions of matter, though always beneath the surface and excluded from light, and yet in all bodies of this kind light is necessary; yet starch is formed in tubers and subterranean stems; it is not carried there already formed by the sap, it is a substance formed in the place where we find it, and by a force residing in the cells of the root or stem itself. Accession of matter may be made to growing bodies in darkness as well as in light; pumpkin vines increase in length rapidly in the night. The previous stimulus of light is probably necessary to these results.

We recognize in the forces which have been spoken of external and internal forces. Light and heat are external, and it is remarkable that vernal and autumnal heat and light produce modified results. Heat begins to decline in intensity by the middle of August, as may be observed by consulting the table of temperature recorded in the second volume.

Mulder takes the ground that force can not be transferred from one being to another—from the parent to the offspring. If this view is admitted, says the same distinguished chemist, then the transmitted force is lost to themselves. This idea of Mulder's seems too mechanical; and indeed why is it not true that force is lost? Trees which bear heavy crops will bear usually only on alternate years. The peach is supposed by Downing to be enfeebled by allowing it to ripen a burden of fruit, the ultimate consequence of which is, that it is attacked with the yellows, and is irrecoverably lost. What is called vital force is here expended, and expended in the ripening of seed. Trees in a state of nature never produce excessive crops, and rarely, if ever, exhibit a premature decay, and yet it will be observed that they have their bearing years; but the cultivated trees do exhibit the effects of excessive bearing, in a premature decay and death. But annual herbaceous plants, as the poppy, produce multitudes of seed, and die, having as individuals performed their functions. The position which Mulder assumes may be right, yet it seems to me that his argument is wrong if we appeal to phenomena. Whether right or wrong, theoretically, it is necessary to bear in mind that, in consequence of excessive bearing, trees become enfeebled, and may soon perish from the induction of a chronic disease or from mere exhaustion. All intelligent pomologists agree upon this point, and point out the remedy, which consists in removing the unripe fruit; and it would appear that they suffer more from the ripening process than in the early growth of the fruit.

The production of a new being is only functional, and, like other functions, is liable to derangements. Excessive action of the liver and kidney is followed by a state of comparative inaction; and there can be no doubt that the inaction is due to a loss of force. The organ first suffers, and if it does not soon recover the whole system is sure to suffer also. But there is connected with production health as well as disease. Force should be exercised, and it only remains for us to ascertain how much force can be expended, and yet vigor or force preserve its strength unimpaired. Life is not shortened by the use of the organs; all that is requisite is to prevent excessive functional action.

One of the most important results of force is the production of definite compounds: the quality of force is not expended in the production of definite forms. These two results are of the utmost importance. By the production of form we are furnished with one of the characteristics of matter, the identity of species: it is true in both of the kingdoms of nature; a kernel of wheat has its characteristic form as well as a crystal of quartz, and so they have also their characteristic composition; the first is a symbol of the last—when we see the first we insensibly recur to the last. These facts are so important that the existence of life on the globe depends upon them; if the first was not a symbol of the last the selection of food would be impossible. Men seem to have acted instinctively in this matter. The laws of combination and the laws of form are but recent determinations. The combinations of organic bodies may admit of greater latitude than those of inorganic bodies. There is, however, always in force the law of definite combination among the atoms of bodies. The modification of properties follows from the slight latitude which is allowed; the smybol or outer sign remains in force still, the slight change in composition is indicated by change of property. This fact, if closely studied in connection with analysis, would become highly useful. The cultivated sense would soon be able to distinguish the glutinous wheat from the starchy; even now, observation supplies us with many characteristics by which change of composition is clearly indicated. On this subject we scarcely know which to admire most, the production of definite forms, or symbol, or the production of definite compositions. Our admiration will not be diminished if the former should be proved to be a consequent of the other.

There is still another important point to be noticed in this connection; it is the infinity of combinations possible among a few of the elements, as oxygen, hydrogen, nitrogen and carbon. Elementary works on chemistry supply us with data on this subject. What we are most interested in, as a fact, is the preservation of identity in each of the combinations. If identity was lost by these multiple combinations, many of the designs of nature would be frustrated; but as the constitution of nature, by the distinctiveness of force, preserves the identity both of living and dead matter, in all the infinity of its combinations, we are always enabled to make all the proper distinctions among bodies. It is this fact which gives importance to mineralogy or the study of outward forms, or the study of natural history in general. We wish for a general expression of nature; we can only obtain this by the observation of outward forms: this prepares the way for another step, the connection of form with substance and combination; it is here that mineralogy and chemistry meet. A refined agriculture is interested in the promotion of this study. The products of the soil may be modified by culture, and numerous varieties of grain, having each their peculiar properties and uses in the economy of domestic life, may be produced, which shall add to the comfort of the household. How to control the law of combination, however, has not yet been determined: most of the results of change in composition and production of variety has been rather the result of accident than of well directed experiment. An element which enters into these investigations is time; for it can not be doubted that the time or season of production is important. The development of modified forms by change of circumstances requires a fuller investigation. Heat and light hasten the

stages of development, while cold and darkness arrest the same. It would seem that in color, too, there resides a force more or less positive in its influence on development. Light transmitted through colored glasses hastens development in some cases, but retards it in others: it may not be fully determined, however, whether, in such arrangements, an injurious matter is arrested by which the intensity of an active element is diminished, or whether it is the power of color alone which determines the result. There are facts which indicate that there is a force in color, independent of other qualities of matter. The apparent force in color, it is true, may be somewhat analogus to the power or force of quantity. It is well known to chemists that quantity of matter is important in effecting changes in composition: in these cases it is not a new force which operates, but the same force increased by using a larger quantity of matter. We may, probably, secure important results in husbandry by availing ourselves of this law: combinations may thereby be formed which are unknown without its aid. In plants disease rarely, if ever, follows from a great supply of nutrient matter: the assimilation in plants seems to be equal, in all cases, to the task imposed. In animals there are limits to the power of assimilation; much may be done to favor the growth or increase, by judicious adjustments of food to the condition and age of the animals.

How is it that force is lost, in the process of time, by a growing body? In annual plants it would seem that the great effort and design of nature is the perfection of seed. To effect this, the forces of the plant are, as it were, directed and concentrated to one point: when the seed is perfected the work is done. But during this process many important changes have taken place in the individual; induration of the tissues or an impervious condition of the channels of circulation have taken place, and the functions of the organs are impeded; the incrusting matter of the cells, the essential organs of vitality, interrupt the free communication of the fluids essential to growth. Considering these changes as due to chemical action, it is unphilosophical to suppose that there is a loss of vital force. In the galvanic battery, the incrustation of the plates diminishes the activity of the machine; it is a mere mechanical obstacle, which being removed and it works with the same force as when first put in operation. But in plants some of the outward conditions are changed; heat and external force has diminished with the progress of the season. More than one cause, therefore, exists for the apparent result that vitality exhausts itself by its own action.

The most curious exhibition of force is that which is furnished by presence, of *Catalysis*, so called by Berzelius. When the temperature of the common oil of vitriol is raised, and alcohol is dropped into it, the oxide of ethyl and water are produced, which may be distilled off, without diluting the acid. In this case the sulphuric acid remains unchanged, and does not combine with the elements of alcohol; but its presence decomposes the alcohol, and will continue to do so for any period. There are many changes which may be classed under this head. Thus the action of sulphuric acid on starch, by which the latter is changed into dextrine, is a very remarkable example of catalysis, or the exhibition of a force by mere presence. Elements are often active in the vegetable which chemists class under this head. Diastase, in its transformation of sugar into carbonic acid or gum, is one equally familiar to the practical chemist;

it is a remarkable example of the economy of force; a grain of yeast or a grain of diastase is sufficient to change any quantity of sugar into gum or carbonic acid. If there was a mutual combination of elements in this case the force resident in the yeast or diastase would soon be exhausted, and no farther change could occur; it merely disturbs the forces in other bodies, without being affected itself.

COMPOSITION AND ARRANGEMENT OF VEGETABLE TISSUES.

The frame work or skeleton of vegetables consists of a net work of interlacing fibrous matter. The organized element in all tissues is a cell. We may enumerate the parts of an organ thus: *cell*, *fibre*, *tissue*, *organ*. Fibre, is formed of cells, and tissue of fibres, and organs of tissues. A combination of organs make the individual. The simplest individual is a single cell. The station which such an individual occupies is the lowest possible. A vegetable then may be regarded as a congeries of cells; or in truth a congeries of individuals, each of which performs its own function, independent of, but in unison with those of the group. A cell, however, elementary as it appears, does not come into existence by a single act: it is built up in stages, or has its growth and development; the microscope reveals this. A cell, therefore, is not produced like a crystal, whose particles coalesce, or arrange themselves in one act. A crystal, however, like an organ, is made up of an infinitude of regular and similar atoms; yet, unlike the force in crystallization, it is internal. If we go back to the earliest stage of development and formation, there is a close resemblance in the action of forces incident to the formation of a crystal and the incipient steps in the cell process: a drop of liquid containing cell matter, and a drop containing crystalline matter, exists under circumstances quite analogous; condensation in both cases would result in the union of contiguous particles; in the one case, there would be granules, which may be regarded as the first stage of a cell, constituting a nucleus, in the latter a union of molecules constituting a crystal. When, however, we conceive so much accomplished, the operation of the forces ceases to be analogous; the crystal continues to be built up by the union of similar molecules, applied to each other upon external surfaces. There is nothing developed in the interior, as in the construction of a cell. It may be, and probably is wrong to regard even the incipient steps in the formation of a cell as a crystallization. What I mean to say is, that it is only in the incipient stage that the processes resemble each other at all. A crystallization in a tissue is a diseased or abnormal condition; the formation of crystals called *raphides* in the vegetable, as in the bark and trunks of trees, interrupts the performance of the functions. Analogous deposites of bony matter in the tissues of the heart and large vessels in elderly people is a disease, or an abnormal condition, which produces, in some cases, death. In beings where the principle of life is concerned, it is philosophical to suppose that they are governed by laws quite dissimilar to those which govern matter, in their origin as as well as in their mature forms, however much their phenomena may be alike in certain stages. No doubt changes take place which are invisible, which are truly functional, and not physical. We may, therefore, suppose that in the formation of granules, which precede the cell, the

movement or force is functional; yet all which the microscope reveals is so closely allied to the physical, that some are constrained to regard the incipient stage of a cell as formed by physical forces. In tracing backwards the changes incident to the formation of a cell, we may probably regard all the visible changes as functional. A granule preceding a cell, as one of its stages, performs no doubt, a function, without which no cell would be completed, but the granule performs none of the functions of an individual cell; all its relations centre in the cell, not in the organ or complete individual—its function is formative. We go back a step farther, where the granule is diffused matter, in a liquid, and we find nothing visible or tangible; the liquid then stands in the same relation to the granule that the granule does to the cell—or is it unphilosophical to reason backward? We certainly get into the region of conjecture, and all we have to guide us is analogy.

The granule is not a part of the cell. After the cell is formed, it may often be seen attached to its walls. It is difficult, it is freely acknowledged, to conceive of the granule producing cells destitute of vessels: all our conceptions of growth are formed from an apparatus which is vascular; but in animals, as well as vegetables, cells are formed without the aid of vessels. The formation of ova and the epidermis are among the examples which may be cited: we connect the animal and vegetable kingdoms together by this fact, *the plant-like growth of tissues and ova, or growth without the aid of vessels.* It is the great discovery of SCHWANN, that one common principle of development for the elementary particles, or granules, prevailed in both the animal and vegetable tissues. The blood globules, or corpuscules, and the muscular globules, are vesicles, or cells, of a common origin; they each originate in a non-vascular or structureless substance, and hence the primitive stage of existence in all organic productions is alike. The essential characters of cells, in both kingdoms, is activity: this being true of the individual, is also true of a combination; activity preserves life, and life preserves activity. The performance of the normal function constitutes health; abnormal, disease; cessation, death. This activity, resident in a cell, determines the difference between an organized molecule and an unorganized one, which may be seen in precipitates, which are often membranous. The precipitated molecules perform no function—generate nothing, while the cell granule, which is so analogous to a precipitate, does actually generate something by its force or activity: hence a generating force is characteristic of organized matter. If granules are non-vascular, how do they generate vesicles or cells? By inhibition, matter is increased, and the cell starts out, a membranous vesicle, from one side: cells coalesce and form fibres, tubes, straight and spiral. The fibre is sometimes round and sometimes flat; each form being produced by variation of circumstances.

The form of cells, in both kingdoms, may be alike. For the construction of differently shaped edifices, it is not necessary to use unlike elementary parts. All the varied forms of crystals may originate from spheroids, and all the varied forms of organs may originate from cells of the same form; it is the diversified arrangement of molecules and of cells which give rise to organs of different forms. In this the simplicity and economy of nature is manifested. Nature, while she has all matter and means at her disposal, economises both. A muscular fibre

is formed by rows of cells; so a nervous fibre is nothing more than cells arranged in the same way. Tubes, in their original elementary condition, are rows of cells, the walls of adjacent ends being thinned, till, by loss of matter, they are lacerated; the tube is then formed. A congeries of tubes makes the vascular system; a fascile of fibres the muscular, and rows of globules, vesicles or cells, the nervous. All these are woven together by the elementary cellular system. But the composition of the several parts is different. In the vegetable kingdom, a peculiar matter, called *cellulose*, composes the cells; hence its name: it has its own chemical affinities, and may be tested by reagents. In the animal kingdom, neurine, or nervous matter, has its peculiar constitution; and so each tissue, or organ, its peculiar constitution. A vegetable is composed, in the main, of cellulose; but an animal has numerous organs, and the peculiar matter of the vegetable, chemical cellulose, is unknown in the animal kingdom, though it constitutes the bulk of the food of most, if not all, animals. The composition of cellulose, according to MULDER, is,

Carbon,	44·91
Hydrogen,	6·40
Oxygen,	48·69

Iodine and sulphuric acid impart to cellulose a fine blue color, perfectly characteristic of this substance. We advance at once into the region of hypothesis or conjecture, when we attempt to discuss the nature of the force which presides over the formation of cellulose, muscular fibre, neurine and bone. The body is permeated by a homogenous fluid; the blood, in animals, and the sap, in vegetables; there is a symmetrical whole, made up of organs diversely constituted. It is a system of unlike parts, united into a unity. The liver, in some of its characters, reminds us of a kidney. Neurine is infinitely removed from muscular fibre, in its properties and functions; and yet it is derived from blood. Blood contains the constituents of muscles, nerve and bone; sap of vegetables, the bark, wood and leaf, chlorophyle, etc. Oils, fats, gum, starch, dextrine, bile, urine, gastric and pancreatic fluids, mucus, saliva, are all products of organization, having a common origin: these are called secretions; their production seems less mysterious than bone, muscle, neurine and cellulose. These last are formations preceding the first; and the mode and manner, or the force concerned in separating their elements from an homogenous fluid, the blood, is more familiar to us. Going backwards to their starting points, we can see that molecular groups are produced: we see a fact in natural history; we know there must be a general law of production, but we can get no farther than to see that a peculiar series of phenomena belong to the formative stage of all organs. To resolve them into a kind of attraction is unsatisfactory, and yet it is the most rational hypothesis which has been framed. Every thing endowed with what we call life exhibits phenomena unlike any thing in inorganic conditions. The formation of iron, in a blast furnace, is preceded by the fusion of many kinds of matters; the iron separates as the fusion proceeds: the iron existed in the fused mass, as neurine and muscular fibre exist in that plastic material, the blood; all are separated from homogenous fluids. But gravity in the iron, and the affinity of its particles, are principles unlike

the matters composing the blood; we have to suppose a force unlike gravity and affinity, as it exists in inorganic matter. The development of organic bodies is not a precipitation; MULDER was right in this assertion: but he resolves the organic formations into peculiar activities, which belong to oxygen, hydrogen, nitrogen and carbon; their combinations are of a mechanical class. So, too, we may say, the peculiar heat, termed animal heat, and generated by chemical combinations in the body, is of a class not identical with the species, culinary or solar heat. But it is extremely difficult to discern the difference between animal and culinary or solar heat. There is a class of forces resembling vital forces, not so unlike them, at least according to some philosophers, as the chemical: the electro-magnetic attractions, for example. The poles of a battery attract acids and alkalies to them; the acids go to the positive pole, while the negative receives the alkalies. For one, however, I never have been able to recognize in the phenomena of life electro-magnectic attractions, as forces to which formative functions are due. Looking at the elementary organ, the cell, we see that it must be instrumental and active, in separating from the blood the secretions of the body, bile, urea, gastric fluids, etc. The cell membrane is the instrument, but whether it is an electrical force residing in the membrane is an unsettled question: that it is electrical is not proved. But we must be careful and not overlook the properties of the fluids acted upon, as I have elsewhere stated. Bile exists in the blood, and there must exist in bile a property, *sui generis*, by which it is possible for separation to be effected by the liver; or, the organ and the matter separated must stand in certain relations to each other. The liver can not separate urea, because urea has not the same relation to the bilary force that bile has; that is, the result is not due entirely to the organ. We still regard it as the instrument, an instrument adapted to the properties of the bile, otherwise it would be no instrument at all. Spongy platinum acts in a particular manner upon hydrogen; it condenses it, till finally it burns; nitrogen thrown upon spongy platinum exhibits no such phenomena, for there is absent a mutual adaptation by which condensation and combustion can ensue.

I have, thus far, been speaking of matters pertaining to development of cells. A question, in this connection, comes up directly, how organized beings grow; or what is growth? It is evidently an increase in the number of cells, and their enlargement. The pervading fluid of the cells contains matter for new ones, and these continue to be produced, till the number required by the organ to which they belong is completed. The cells, from that moment, cease to be produced, and growth is effected by their enlargement. There is an elongation of the axis upward and downward, the elongation taking place mainly at the extremities of branches. The roots extend, or grow, entirely by the production of cells at the apex, or end of the root, which terminates in a fringed organ, called a spungiole; the extremity is thereby pushed forward by the newly developed cells. This elongation of the root continues during the life of the plant. At first the growth is downwards, and in many trees, as the pine, large tap roots are formed; but the progress in this direction is limited, and soon the growth is horizontal.

But trees increase in diameter. When in the spring, in temperate climates, the individual tree is permeated by fluids, an organizable fluid is poured out from the entire surface of the

wood and bark formed the preceding year; or the inner surface of the bark and outer surface of the wood, while thus surcharged with sap, form two layers of cells, indistinct at first, in consequence of an excess of transparent fluid. These cells, whether developed directly from the surface of the wood and bark or in the fluids poured out, are rapidly and simultaneously formed, and in due time constitute the wood—a new layer of growth. The tree increases in length by the production of cells, but in breadth, the lateral growth, the cells are all equal in size, and never produced within them new cells.

CIRCULATION IN ORGANIZED BODIES.

The nature and character of all organized bodies requires that their tissues should be traversed by a fluid. This fluid should contain all the elements of nutrition: unless this is the case, vegetables would cease to grow, and animals would perish by starvation. The fact that there is a circulation is proved by occular inspection; but occular inspection has not, as yet, been competent to determine all that is maintained by physiologists with respect to it. By some, it is supposed there is a double circulation; that is, the fluid or sap rises in the stem of the plant, reaches finally the leaves, where it undergoes certain changes, and thence it begins to descend, till it reaches the root, having gone through the entire tissues of the plant, by an upward and downward movement. But is this double movement proved? I think not. Theory assumes that it is a function of the leaf to effect a change in the circulating fluid, and upon this change the growth of the plant or tree depends. Facts, however, show that the sap is changed in the tissue of the plant, and before it reaches the leaves. This is a function of the cell wall and the fluid which it contains, being probably in part functional and in part chemical. The sap passes on to the leaf, and in the spring, in temperate climates, it finds undeveloped leaves in the buds of the preceding year. In the perfect development of the leaf the sap expends its nutritive matter; that is, it develops new cells, and at the same time the superfluous water is exhaled from the growing and perfect leaves. By this arrangement, too, the stem grows, being elongated and increased in diameter. We see too, in this arrangement, the source of this power, which moves the fluid; the surface cells being deprived of a portion of their fluids by exhalation, they are prepared to imbibe or receive a new supply from the contiguous and comparatively distended cells. The great extent of surface over which this exhalation goes on is competent to influence the whole mass of fluids in the tissues of the plant. Those who maintain the double circulation appeal to experiment: they say that where a tree has been girdled, it may live, but it will grow only above the girdled zone. This is, however, an error of observation; the tree still grows below the girdle, and what is important is, when some trees are cut off, they may continue to grow slowly, producing new wood around and over the extremity of the stump.

There are many anomalies in the growth and nutrition of vegetables. The possibility of sustaining the life of trees by introducing its sap laterally, is also proved; and hence the fact that it may pursue a retrograde course can not be overlooked; still the normal course and direction of the sap is, probably, similar to the view which I have hinted at. In the spring a

great amount of cell matter is formed, which appears to be deposited between the bark and wood; this cell matter, called by some cambium, is derived from the inner cells of the bark and the outer cells of the wood; it is really a multiplication of cells, from the bottom of the tree to its top, a simultaneous production of new cells throughout the whole extent of the surfaces concerned. In time this pulpy matter, which consists of immature cells, becomes lignified and hard. It is not a slow development of cells proceeding from above downward; it is a cell growth, having its power seated entirely in the preëxisting cells. The bark produces its own peculiar cell, and the wood its own; for the character or structure of the bark cell is unlike that of the wood cell. The sap, flowing down between the bark and wood, has no power in itself to produce cells; it would be merely extraneous matter: it is only by cell power that new cells or growth is effected. The doctrine that there is usually a downward circulation seems unnecessary: that fluids may take this direction, under certain conditions, is probably true; and I do not deem it an established fact that the movement of sap is entirely due to the leaves, inasmuch as the sap ascends before the leaves are developed, and also in that peculiar process already alluded to in overgrowth. In these two facts we are driven to acknowledge in growth a cell power; but we are not driven to the necessity of admitting that exhalation, in either of these cases, is wanting. In organized bodies, production presupposes a producing organ: it produces its like—it multiplies its identical self and nothing else. We could have no certainty that an extraneous, unorganized fluid, though circulating within the pale of a vegetable, would produce the identical cell of the vegetable; a special organ only can do this.

On the conveyance of food through the root and all parts of a plant, Mulder makes the following remarks:* the substances existing in the soil, in the state of liquids, are absorbed by the roots, by endosmotic action; that is, the cells of the fibrils are filled with one liquid, and are surrounded by another, which is present in the soil. The latter fluid is less saturated than the former, and hence it penetrates through the cell walls of the epidermis of the fibrils, in the very young cells especially, where the fluids become diluted. From these cells the liquid enters the adjacent ones, and so on, till it traverses the whole plant If we commence with the leaves and proceed downward, we find first, that on their surfaces evaporation takes place; the liquid becomes more concentrated thereby, but this will be diluted endosmotically by the thinner liquid which exists in the neighborhood; this thinner liquid exists in the adjoining cells below, and thus the most dilute and thinnest of all is found in the fibrils of the root; and in the soil surrounding the roots it is still more dilute. The connection is therefore very close, according to Mulder, between the absorption of the saps from the soil through the root, and their ascent into the plant; both being ascribed to one cause.

The inference is then drawn, that growth, the ascent and the absorption of nutritive matter from the soil, depend on the evaporation from the leaves. The solutions of matter which are taken up by the roots are extremely dilute; even many coloring matters will scarlely pass

* See p. 621, Mulder's Chemistry of Physiology.

through the cell walls of the fibrils. A solution, therefore, must be perfect; and all such solutions may be received into the tissues, and pass the cells; it makes no difference whether the solution is nutritive or poisonous, it passes in: if poisonous, or in other words, if it affects the cell wall chemically, as solutions of corrosive sublimate or arsenic would do, the plant is destroyed; it has no selecting power, no discrimination of what is good or bad. In order to be taken up the matter must be perfectly dissolved. It is however supposed by MULDER, that the roots have, in their endosmotic power, different relations to the matters absorbed; so that some substances are more readily absorbed than others. The fact is undoubtedly true that some substances are more readily taken up; whether however the power denominated endosmose is the power, admits of a doubt. There is a dislike to the idea that a mere dead membrane is competent to the performance of the functions under consideration. There is, however, much in the doctrine which is plausible; and the illustration which endosmose furnishes to the promotion of the circulation, is well worthy of a notice, as one of the probable forces concerned in the circulation of the saps in vegetables.

NUTRIMENT OF ORGANIZED BODIES.

There is no necessity in maintaining the opinion that plants are endowed with an extraordinary power for selecting nutriment, and of rejecting matters injurious to them: the original constitution of the rocks, and the adaptation of plants to the soil, do not require this; although the matters of the soil are heterogenous, still there are so few elements which are injurious to them, that the power of rejecting those would be of little or no consequence. All plants are furnished with the same elements; then whatever differences we may observe in the vegetable productions must be ascribed to the combining and modifying powers of each individual species. The stem of a plant differs, in composition, from the leaf, and the chaff from the grain; not because the root made a special selection of materials from the great store house, the soil, but because each part is fitted to arrange and combine the matters taken up by the root, in its own way and according to its peculiar structure. There is a remarkable difference in the growth of plants and animals: the latter undergo a continual waste of their organs during their whole period of existence; this waste is the most rapid during the period of its most rapid increase: plants undergo no waste, properly speaking, though it was supposed by many physiologists at one time, that the extraneous matter, or waste, was rejected by the roots, and cast forth into the soil. This view of the waste of plants finds but few advocates *now*. The only waste which plants suffer is from exhalation of water from their leaves, or from their general surfaces. The injurious or poisonous matters, either to plants or animals, are confined to narrow veins in the rocky strata; hence they can really exert no influence on vegetation in general. There is but one exception to this; the proto-salts of iron exert an injurious influence upon plants. This salt is formed by the decomposition of pyrites, diffused through some of our common rocks: this salt, after all, is rarely in such quantities as to require much attention; it is easily disposed of by lime, being in its turn decomposed, the sulphuric acid of the sulphate of iron going over to the lime and forming gypsum or sulphate of lime.

All the nutriment which plants and animals require exists in the rocks, or has existed in them. Of these matters, silex, iron, lime and its various salts, magnesia, phosphates, etc. are the most common, and these are generally distributed; while arsenic, mercury or quicksilver, or rather their salts, which are poisons, are only found in very limited quantities, in veins. Now how is it that there is, apparently, a selection of food by plants? I may say, in answer to this question, that it arises from the structural differences of species. There are potash plants and lime plants; that is, some seem to require more potash, or lime, than others. This apparent selection of potash, or lime, is due, as already hinted, to the original constitution of the plant; in other words, it was made of such materials, and its elementary parts were so arranged, that it is adapted to those special nutriments, and hence to take them up. This leads us to adopt the view that there is a speciality in the creation of beings, which extends itself to every species. The tobacco worm thrives upon this nauseous and poisonous weed; who can doubt its special adaptation to it? for it is certain that it can not be ascribed to habit. How is it that marine plants live only where salt abounds? It is not because they have become habituated to it. There are many strong instances of this kind; but wheat, rye and oats, though allied to each other, are equally special in their structure, by which speciality each one absorbs by its roots (because of their structure) more of the special element they require, than of others which they do not so fully demand.*

Agriculture has not advanced yet far enough to enable us to adjust the amount of nutriment required by any crop. What agriculturists now aim at, and it is the most they can do, is to put within the reach of each plant all the nutritious elements its nature demands. These elements have been determined by analysis of the different parts of plants; and very many of them may be found and consulted, in the second volume of the Agriculture of New-York. The elements of nutrition are not confined to the soil: the atmosphere is regarded by many as the great store house of carbon, the basis of vegetables. It has not been proved, however, that the carbon of plants is derived solely from the atmosphere; and the fact that a great abundance of carbonic acid, and carbonaceous matters, is found in the soil, and enough to satisfy the wants of vegetation, is a fact in itself of sufficient importance to lead us to question the opinion that plants derive their carbon directly from the atmosphere. It is not enough to know that it is stored up in the atmosphere: its solubility in rain water rather indicates the mode by which it may pass into the vegetable tissues. Practically, it would be of little consequence to determine the fact if plants derived their carbon wholly through the leaves; for, as the amount of carbonic acid in the atmosphere is always the same, and the ability of plants to imbibe it can not be changed, they of course will take in their supply of this material, without cost or labor to the husbandman. In this view carbonaceous manures would lose some of their importance. If, on the other hand, plants derive their carbon from the soil, through the medium of the roots,

* All that can be said is, that each species has its own organization, by which it lives its own and peculiar life; it is merely a statement of an ultimate fact. We may profitably ascertain, by observation, these peculiarities, by aid of the microscope.

then the farmer may aid the plant in its growth by giving it organic matter as a fertilizer. Carbon is, as it would seem, the only substance which is claimed to be furnished vegetables from the atmosphere. Of gaseous matter, nitrogen and ammonia it is acknowledged must be diffused through the soil, and taken up by the roots in solution and combination. The disappearance of carbonic acid from a given volume of air, when it is made to pass over the leaves of plants, may be due to a simple condensation upon surfaces. This condensation, of course, must first take place; but it does not necesarily follow that it is absorbed: other experiments are required to put the question at rest.

The nutriment of plants is of two kinds, one which consists mainly of carbonaceous matter, (organic,) and another in which mineral matter is the princpal ingredient. Both are important; both must be added to the soil; both are usually combined together, though the mineral matter may, and often is, added by itself, as when plaster and burnt bones are employed. Decayed vegetables, barnyard manures, etc. consist of organic and inorganic matters, and there is little doubt but that crenic and apo-crenic acids, in combination with mineral matters, form one of the most important nutriments for plants. The office which mineral matter performs, in part, in the vegetable tissues is to strengthen the texture; it forms a skeleton, or frame work. This skeleton, as I have elsewhere observed, may be seen when all the organic matter is burned; and in all plants this skeleton represents the arrangement of the mineral matter in the plant. In some it is strong, in others it is weak; the bark always furnishes a heavier skeleton than the wood. This skeleton is the ash. Grasses and culminiferous plants have a skeleton made up mostly of silica, while in most plants it is a carbonate of lime and phosphate of lime, as obtained by combustion. The bark of trees, as may be seen by analysis, consists of carbonate of lime, mostly, or a basis of lime in combination with an organic acid, when in its original condition.

Aliment, before it can pass into the tissues of the plant, must be in the condition of inorganic matter. Muscle or cartillage can not nourish an animal, until it has undergone a dissolution; it must be resolved into its elements, and the same fact exists in the vegetable kingdom; none of the organized products are in a condition to sustain life, until they have passed into an inorganic state.

There is no doubt now in regard to the importance of organic matter in the soil. The view which has been maintained by physiologists of high standing, that the products of decomposing vegetables were of little or no value, has been discarded. The view too that carbon may be derived from the atmosphere in sufficient quantities to meet the demands of highly cultivated crops, is seen to be fallacious. It is now well known that a proper mixture of mineral and organic or vegetable matter is essential to constitute a fertilizer. Plants differ, however, as to their wants; some require more mineral matter than others. It is with them as it is with many plants in other respects; some have a large root, and some have no root at all, or an exceeding small root; and some, too, are very leafy, others without leaves: hence a theory of nutrition which is designed to comprehend all the facts and phenomena of the subject, must have regard to many anomalous cases of vegetation and growth, as the leafless plant, the plant with heavy succulent leaves, the air plants, mushrooms, lichens, etc.

The facts regarding manures then, are, that permanent ones must consist of a combination of organic and inorganic matters; or, that the elements of organic matter must, in some way, be combined with the inorganic. If fields are manured with inorganic matters, as leached ashes, gypsum, etc. those fields in time cease to be fertile. Thus the farmers of Long-Island, who have been in the habit of using leached ashes for a few years, find that the effects at first are quite decided, yet soon they begin to decline, and after a while cease to exert a favorable influence upon vegetation. There seem to be, in facts of this kind, a distant analogy in the nutriment of plants and animals; a change of diet may be required in both kingdoms; the appetite in animals indicates this in the animal, and the general effects of one nutriment, long continued, indicates it in the vegetable kingdom. Dogs when fed upon gelatine alone, soon lose their appetite, and, if persisted in as food, they will starve upon it. Yet gelatine and starch, under some conditions, is nutritious, and, for convalescents from fever, is one of the safest kinds of nutriment, and one upon which the system is known to thrive, and gain flesh and strength. Combination of elements, and a change also of the compounded matters, are required by both classes of organized bodies. We find the organic elements in all cases in the ash of the organs, both of animals and vegetables. It is true some of the lowest forms of vegetation, as the mucors or moulds, according to MULDER, leave no ash or residue on being burnt. These may, and must be, however, regarded as mere exceptions to a general law. Those who feed animals for market know well that a change of diet is necessary to bring them to the highest state of perfection. The natural rotation of crops is a fact which points to the same principle. Experience then, and observation, agree in sustaining this important principle of cultivation and of feeding. The dictation of an appetite, in the case of animals, should be heeded; and the deterioration of vegetables, when fed with a single nutritive element, should also warn us that a change of treatment and diet is called for.

ROTATION OF CROPS.

A rotation of crops, as a means for increasing the products, has been regarded as one of the means for sustaining and prolonging the fertility of the soil. What is the foundation of a practice so general and so much approved by practical men? Observation has brought to light the fact that no crop can be sustained, for a long period, on the same area. This fact is not disproved by another—that there are spots of great fertility, and abounding in nutriment, which is stored up in the soil: some of the western bottoms on the Ohio and Mississippi are exceedingly productive for years, even in Indian corn. These spots contain a great abundance of all the elements of nutrition required by the plant: but this is the case with very limited areas only; the greater part of the earth's surface has, at any one time, but a small amount of the essential food of plants in a condition fit for the nourishment of vegetables.

When we find, therefore, that a crop begins to be less vigorous and productive, after cultivation on the same field, we may conclude that it has exhausted one or more of the essential elements of nutrition. Now, although this same plant, or crop, may not thrive, still experience

has proved another thing, that a different plant, or crop, succeeds well upon this very spot. This last plant may also cease to produce itself vigorously, and then again another change is called for. These successive changes is called a rotation; and these rotations have been followed for many years, during which the direct application of manures has been dispensed with. The fact that success attends the retation of crops, proves that plants do not require the same element of nutrition in the same proportion. Other views of the subject have been entertained, but there is no doubt that the foregoing is the true one, viz. that a plant so far takes up and removes the nutritive elements, that the amount necessary for perfection is not accessible to the roots. Now it is highly important that every farmer should be fully impressed with the fact that whatever rotation of crops is adopted, the exhausting process goes on. This is denied by many, especially by the wheat growers who rely upon plaster and clover to sustain their wheat crops. Every bushel of wheat contains a large amount of potash, and of the phosphates; and as plaster does not contain either, it is undeniable that the exhausting process is going on by this mode of cropping. So too, pasture lands, although their productiveness may not diminish rapidly, yet when the milk of cows is consumed at a distance, in the form of butter and cheese, these too, in the end, will show the same fact. There is another position equally true, viz. that where a farmer has carried through his rotation, the soil at the end of the rotation is thoroughly exhausted. It is not in one element only which is reduced in quantity below the standard of fertility, but there are several, and the farmer who expects that plaster, in this stage of cultivation will restore his fields to the natural fertility, will be assuredly mistaken. And a field thus treated, never can be restored to its original condition, unless the removed matters are added to it. It may recover by rest its apparent fertility, yet rest gives time merely for change of condition, not the addition of a single atom of inorganic matter.

I have explained the grounds upon which a rotation of crops has been recommended, viz. the unequal exhaustion of soils of the valuable elements, by certain classes or groups of plants, so that, although exhaustion must take place, still the farmer is enabled to pursue a plan of cropping, for several successive years, without the labor of adding each year manures or composts from his yards. Those farmers who pursue a plan of rotation, are governed by one principle at least, viz. never, in all his changes of crops, to allow those to follow each other which require the same elements of food to the same amount. Thus, oats should not follow a crop of wheat or Indian corn, or as the common expression is, two white crops should not succeed each other. To us, whose observations are confined to comparatively new lands, this principle does not appear so important, inasmuch as it is customary to plant the same crop, on the same land, for a number of years: but soils which have been cultivated for centuries, and which have been much exhausted, and where the crop must be supplied with nutriment almost directly from the hand of the farmer, it is quite different. The rotation, let it be remembered, succeeds because plants demand unequal quantities of the rare and expensive elements, the alkalies and phosphates for example; not because these plants do not require them all, and can live without them. The rotation which wheat growers of western New-York adopt, is mainly one of clover, aided by plaster, and wheat and occasional year of fallow, which is really a year

of rotation. This rotation is eminently successful, and, in the opinion of many farmers, it is one which will never exhaust the soil, inasmuch as it is maintained that clover constantly takes from the atmosphere its organic matter at least. There are, however, considerations which go to disprove this view of the subject. We can not, for a moment, believe that clover can take any thing from the atmosphere but carbonic acid ; and hence clover can not enrich a soil beyond the amount which it thus derives from a foreign source. Carbonaceous or organic matter, then, is the only class of substances which can be added to the soil : clover can not enrich a soil, except in this particular. In every crop of wheat, however, between twenty-five and thirty pounds of expensive material will be carried off annually, in the grain alone, and which the clover and plaster can not restore.

How then are we to explain the influence of clover as manure for the wheat crop ? Clover is a voracious plant ; it is very vigorous and rapid in its growth ; it sends out roots in a great abundance, in all directions, and which penetrate deeply, as well as widely. The consequence is, that it stores up a great abundance of food in its roots, stems, leaves and heads. The plants have explored a wide territory, and brought to the surface a great amount of nutriment for wheat. Now, although the opinion is quite common that clover is not an exhausting crop, yet if the analysis of the plant is consulted, it will appear that it is really one of the most exhausting of all crops, provided the whole plant was removed from the soil. But its large root, rich in expensive elements, must remain to decay in the soil, and yields its rich stores to the wheat plant which is to follow. The clover plant is, then, more like the commissary ; it does not create, but collects, and its ability for collecting, even in poor soils, is remarkably great : it adds nothing to the soil really and essentially important to the wheat plant, but it brings up from the depths below, and opens passages for the root of the wheat to penetrate.

Again, the soils of New-York are rich, and the wheat region, as I have often had occasion to remark, is based upon a decomposable rock, which is constantly adding to the soil its debris, and which is new and freshly charged with much nutrimental matter ; and so it happens that years may pass, and the fields may produce large crops, and yet they remain fertile, and have not, apparently, lost their productiveness. But many of those rich fields, after thirty years of culture, begin to show the fact, that some of the essential elements of the cereals have become diminished ; and the farmers who once regarded the stable manures as a nuisance, now find it necessary to spread it on their fields. It is, then, only a slow exhaustion from a rich store house, which the father, in his life time, may not perceive, but which the son, in his husbandry, must both see and feel. A fact then, so susceptible of proof when duly considered, should not be lost sight of ; and, although many farmers have sustained losses by adopting a fallacious opinion, as it respects exhaustion, it is not too early to change their views, and adopt practices which shall obviate, in a measure, the injurious results which will necessarily follow from the present system of culture. Clover, instead of taking nutriment from the atmosphere for the wheat or corn plant, gathers its essential elements from the soil in which its roots have penetrated, and which too, by their powerful growth, can push themselves where the wheat root can not until a way is opened for it. The clover plant, when cut for hay, will remove from

the acre from two hundred and fifty to three hundred and fifty pounds of inorganic matter; while the wheat plant removes, in its straw, about two hundred pounds, and in its seed from twenty-five to thirty pounds. The largest amount of removed matter in the straw is silica, which exists in the clover plant only in minute quantities. Clover is, however, rich in the alkalies and phosphates; and hence it follows that a single clover crop will supply a large amount of the valuable and expensive nutriments to two or more crops of the cereals or grains, even from its decayed roots.

This modified view of the value and use of clover in a rotation seems to me agreeable to observation, and to all the phenomena of growth and nutrition. In weak lands or soils the clover tops should not be removed, while in strong soils it is not of so much consequence to plough in the crop; indeed when the growth is large, and can not be broken up and incorporated with the soil, it has seemed to exert an injurious effect. It has been maintained, and is perhaps now the opinion of many, that the value of clover, as a manure, depends upon its organic matter, and especially upon its nitrogenous compounds. Probably a more rational view is, that its great value depends both upon its organic and inorganic matters; and facts seem to warrant the conclusion that the latter are equal in importance to the former. We can not stand upon extreme views; but when it is conceded that wheat does not require large quantities of organic matters, of which carbon is the base, we should certainly be led to adopt a more favorable view of the value of the phosphates and alkalies. I have never subscribed to the opinion that the value of clover, or of any fertilizer, can be determined by the amount of nitrogen it yields, unless indeed it can be shown that the inorganic fertilizers bear a certain constant proportion to it. Those who estimate fertilizers by the amount of azote or nitrogen they furnish govern their rotations accordingly. Clover and grasses, they contend, take azote from the air, and hence there is a real gain—a real addition to the soil; but it has never been proved that any plant can take, or does take nitrogenous matters directly from the atmosphere, and if nitrogenous matters are derived from the soil, after having been diffused in the atmosphere, it is difficult to see the value of those plants, on the alleged principle. Absorption of azote or of ammonia from the atmosphere is an assumption unsupported by a single fact.

The only mode by which azotized matters can be furnished, is through the medium of the soil: ammonia from the atmosphere being one of its main sources, and being also soluble in rain water, is furnished through this medium. If it is once established that it is through the roots that the gaseous products are furnished the plant, the hypothesis on which the rotation of plaster, clover and wheat, etc. is founded, loses its importance; that is, the rotation will not be followed because of the nitrogenous matters of the clover, but because it furnishes important inorganic matters. If the wheat plant were to stand in the place of the clover plant, it would obtain all the nitrogenous matter it requires, provided the rain brings it down to the earth. It is not, however, probable that the atmosphere is the main source of nitrogen. There is, however, another view which favors the hypothesis I have been disposed to question. When clover is cultivated as a fertilizer, it takes its accustomed nitrogenous compounds from the soil,

fixes and stores them up in its substance. This amount, whatever it may be, is the annual supply of nitrogen. The succeeding year wheat is cultivated upon the clover; and hence the plant is in the way of obtaining what was stored up in the clover plant, and also of taking directly from the soil the two annual supplies of the same substance. It has, therefore, or may be supposed to have, a double source for this important substance. Adopting this view of the value of clover, we can not fail to see the importance of clover as one of the essential crops in our husbandry. Whatever hypothesis we may adopt as to its modus operandi, there can be no doubt of its great value, as a member of a rotation of crops; its large growth, both above and below the surface; its vigor and strength; its universal adaptation to soils by means of plaster, are among its admirable qualities, to say nothing of it as a fodder. It may be well to repeat that we should by no means regard the relation which clover sustains to nitrogen as its main recommendation, or as the foundation upon which its cultivation rests. Indeed no single relation should ever be regarded as the sum of utility. There are other unities which must come in for consideration. It is of little utility to discuss the question which is of the most value, nitrogen, the alkalies or phosphates; for it is true that a seed is imperfect and unsound, and valueless, when either is absent; even though one is required in greater quantities than another, still the smaller is necessary to the perfection of the whole. We may talk of the importance of the keystone of an arch; yet it will be found true that the arch will fall if a single small stone is left out, or we may rather say it will be no arch at all, until every stone is in its place.

The forgoing remarks lead me to go farther in the same train of thought. We may observe that there is no crop which feeds exclusively on a single element, or that exhausts a soil of a single element. Every plant, on analysis, exhibits the same elements, as silica, sulphates, phosphates, the alkalies, potash, soda, lime and magnesia—the difference being simply in amount; but there is no greater difference in the composition of two species of plants than between the parts of the same plant. So also, there are variations of composition in the different stages of growth. An inference of importance follows legitimately from the foregoing facts, viz. that a rotation founded and pursued on the principle that the plant feeds upon one kind of food, or in other words, exhausts the soil of one element mainly, is wrong; it is wrong from the nature of the facts, and the relation of the composition of the plant to the elements of the soil. It is true there will be, in such a rotation, an approximation to truth: there is a plausibility which at first recommends to favor. Take a rotation which has been carried out, as the following: manure, roots, tobacco, oats with clover, wheat, beans.* The first crop, corn, exhausts the soil of phosphates and potash; the tobacco, of potash especially; the third of both phosphates of the alkaline earths and of potash; a clover crop intervenes, but it can not restore those important elements I have named; but it may collect and bring to the surface what remains in the soil; wheat, an exhausting crop then follows; and lastly, beans, which is both a foliage and a seed crop, and is exhausting to a great amount. It would be difficult to

* Transactions of the American Agricultural Association, Gardner paper, page 6.

select a series of crops more exhausting than the foregoing ; and on the principle upon which rotations are recommended, it is difficult to defend it from objections of a serious kind. The same may be said of another rotation, referred to in the same paper, viz : manure, roots, oats with clover, beans, wheat. It is rather remarkable that beans and wheat are cultivated as they are, for beans, both in its foliage and fruit or seed, contains a large amount of phosphates. Bean leaves and stems are highly valuable, as a fodder for sheep ; and the bean itself is unequalled by any seed for the amount of muscle and force which it imparts to the system. It seems plain, then, if the foregoing remarks are true, that so far as ultimate exhaustion of the soil is concerned, there can be but slender grounds of choice between cultivating one of those crops, for the same number of years, and a rotation of the many proposed. There must be other advantages in the rotation than those which concern the fertility of the soil, or else the advantages of such a rotation must be questioned. If rotation, then, is of so much consequence, and if those proposed are objectionable, what rotation will be an improvement upon them ? An answer to this question has been attempted more than once ; and there are inherent difficulties in it, arising from the fact that all the products of human industry which are derived from the soil, are expensive : all the cereals and grasses, with the clovers, root crops and herbage crops, are rich either in phosphates or the alkalies, or both ; and as some portions of the crops are to be removed and sold at a distance, exhaustion necessarily follows. In the cultivation of sugar cane it is customary to return a large proportion of the stalk to the soil, after employing it for fire wood. The ability to restore to the soil a portion of the crop, in the form of ash, as in the sugar cane, or in straw, as in the cereals, becomes an important matter, and is not lost sight of by the farmers of New-York, or the southern planter. Now, although much has been said and written on rotation, and the exact order in which crops should succeed each other, I think it very doubtful whether any one which has been proposed is free from serious objections ; and I think it will be clear, on reflection, that there is no rotation which can become general, or which may be followed with equal success in different parts of New-York, much less in the United States. A rotation which may be regarded as suitable in England, will not, on that account, succeed here. In the first place, crops are raised for profit, and in the second place, there is no profitable crop that is not exhausting ; and no farmer will be deterred from raising a given crop on account of its effects on the soil, provided only it remunerates him better than any other production. Then again, that crop which is profitable near a city or village, is not one which will pay in the country ; location and market must, therefore, govern the husbandry of a country to a great extent. When it is once fully felt that land refuses to yield its increase, because an important element has been removed by cultivation ; that it is not owing to any injurious substance imparted to the soil by the crop itself ; that the whole difficulty, so far as soil is concerned, in raising perpetually any given crop, resolves itself into exhaustion, and nothing else, then the farmers will not be troubled in devising a rotation for the sake of a rotation. The principle which will govern him will be profit. But as profit forbids a course of husbandry which will end in exhaustion of the soil, or in the growth of weeds, that plan will be pursued with due regard to the preservation of the soil in a healthy condition ; and hence,

I believe it more probable that the farmer will find it more profitable to use that amount of manure which shall enable him to raise that kind of grain, or stock, or pursue that course of husbandry which his location and position will dictate.

But a succession of crops is not an indifferent matter. Wheat will not succeed well in a highly manured field, while maize, or Indian corn, can scarcely be manured too highly. In seeding down a field it is not a matter of indifference what crop is to succeed: oats may be selected as the crop to succeed a grass and clover crop; a hoed crop, as potatoes, is good preparation for wheat, if the tillage has been thorough. But a short course, like the following, is more generally adapted to the soils of New-York than any other: 1. manure: 2. Indian corn: 3. oats and clover, and ending the rotation with wheat. But wheat may succeed Indian corn, then clover, and wheat again. In this country it is rare to make a potato crop a part of a rotation; and turnips have not been cultivated to that extent here which they have in England and upon the continent. This arises mainly from the estimation of maize; though it may be regarded as an expensive crop, still its value warrants the expense. It will be seen, by reference to the analyses in the second volume, that wheat, if its straw is regarded, is a silica plant; and in some varieties potash is also a prominent element, while the phosphates are reduced to a small quantity; sulphuric acid is also quite prominent. The composition of the chaff does not differ essentially from the straw, though the phosphates are often reduced to a minimum, and the silica increased to its maximum quantity. When, however, we examine the composition of the grain, it must be ranked as a phosphoric acid plant, as the phophates constitute more than one half of the elements of the grain. Potash is prominent among the elements: soda is often a variable element. In the grain sulphuric acid is not so prominent as in the straw. Beans are as rich in phosphates as wheat, and more so than barley. Barley requires, apparently, the organic salts of lime; the straw of barley is not so siliceous as wheat, and that of oats is less than either; in fact oat straw may be regarded as a tolerable fodder for cattle, especially if cut early: sulphuric acid is found in each. In wheat, chlorine is a scarce substance; and hence it would appear that the practice of some farmers, of employing salt as a manure, is of little utility. The ash of potatoes is more than half potash, but the ash is a small percentage; still when it is considered that a potato crop is large, it will satisfy us that the amount of expensive material removed is very great. The same is true with the turnip, but the potash is less in amount. The common hay crop, being one in which lime (probably the organic salts of lime) abounds, may follow or succeed a crop in which potash, or the phosphates are prominent substances. Timothy, red-top, and clover furnish considerable carbonate of lime in their ash.

The expensive elements of the soil which are liable to exhaustion, are phosphoric acid, potash, soda, lime and organic or nitrogenized matter. A rotation, where fear of exhaustion guides the farmer, will have reference to these bodies. Silex, iron and alumina, are each abundant in most soils; silex at least, is never wanting, though it may not exist in a soluble condition; alumina is present in all soils, except those which are very siliceous; it is not taken up by plants, and hence is not to be regarded as an aliment, but is required in the soil to

give it consistency: alumina is the only substance in the soil which is not, under some circumstances, incorporated into the tissues of plants. Magnesia, in some soils, is rare; it is an important substance, being required in all the cereals, root crops and fruits; all the edible roots, grains and fruits seem to require it, in combination with phosphoric acid. The main point I have aimed at in the foregoing remarks is to show that no system of rotation is of a general value.

The crops are to follow each other in such a rotation as to use to the greatest profit the expensive elements I have named. A fallow or rest; a clover crop comes in as a part of the rotation. I believe, however, the effect of cultivating clover has not been well understood. This I infer from the expression *clover sick*. Land I believe is clover sick only when some of the aliments which clover requires have been exhausted, and the manures employed do not contain them. Clover ash contains silica, phosphoric acid in combination with lime, lime in combination with the organic acids, magnesia, a large quantity of potash and soda, chlorine and sulphuric acid; each one of these is equally important to the plant, and the probability is that when land is clover sick, there is a want of potash; or at least the probability is in favor of this view. In New-York I am not aware that any of our fields have, as yet, refused to bear clover. I think, however, that the change is advantageous on the ground of partial exhaustion of the elements, or a diminution to that extent which a plant begins to feel, it may be potash which has been removed, diminished to one half the usual quantity; there is not enough to supply the wants of a potash plant. When, therefore, a plant which requires less potash is substituted, it may yield a good crop, and in its growth there will be no evidence of a partial exhaustion of this alkali. Properly, the land can never be said to be sick, as though it were pining under some disease, it may always be regarded as an exhaustion; and the true remedy is to supply those elements which analysis prove are either deficient or wanting.

There are also other differences in the composition of vegetables which it may be proper to notice. We may divide cultivated plants, for example, into three classes. 1. Those in which the seed forms the main object of culture. 2. Those which are cultivated for their herbage. 3. Those which are cultivated for the root. Each class differs essentially from the other in the amount of water which they respectively contain. To save the trouble of reference to the second volume, I collected the results, which I have obtained by carefully conducted experiments. I prefer to give my own work for two reasons. The results were obtained from substances grown in the State, and second, my experiments were conducted uniformly, and hence should give uniform results.

Class 1. Grasses.*

	Water, per cent.
Timothy, (May 20,)	80
" leaf,	75
" whole plant,	78
" (June, stalk,)	74
Leaf,	71
Quack grass, (June 8,)	80
Spear grass, (May 20,)	80
Meadow grass,	61
Club rush, (in blossom,)	38
Black club rush, (out of blossom,)	40
Red clover, (May 12,)	86
" (" 20, Hoosic,)	88
" (June 10, stalk,)	80
" (" " leaf,)	73
Whole plant,	77
White clover,	81
Young clover,	80

Class 2. Cereals.

	Water, per cent.
Oats, sundried grain,	10
Another,	9
Straw,	8
Lewis county,	10
Unripe rye, heads,	67
" straw,	55 – 61
" leaf,	69
Barley, grain,	43
Millet, heads,	48
Soule's wheat, (dry,)	10
Hopeton " (dry,)	12
Maize, stalks, (June 5,)	92
" leaves,	87
Another, sheaths, (July,)	92
" leaves, (July 12,)	60

* Taken from the second volume of the Agriculture of New-York.

Note. Fresh bread which is made in Albany, contains 40 per cent of water. Our food, as well as the food of cattle, contains always a large quantity of water; and food which contains but little water, but has an affinity for it, as rusk, is always injurious.

Class 3. Roots.

	Water, per cent.
Potatoes, ronnd pinkeyes,	79·54
" blue pinkeye,	73·71
" pinkeye,	75·
" Scotch gray,	71·
Orange carrot,	from 83 to 89·52
Blood beet,	86·42
Turnips,	88·
Mangel wurtzel,	85·

It will be observed, on comparing the foregoing classes, that water is much greater in the roots than grain. The state in which these classes are fed, is also worthy of note; the grains and grasses are fed dry, while the roots are fed green, they being so constituted as to retain their water for a long time after they are removed from the earth; while grains and grass become dry and are fed in that condition. The amount retained in the grains and grasses does not differ materially, and if the root should undergo a like depreciation, they would resemble the herbage of plants; the grasses when green lose on drying about 80 per cent of water. Now, from the great amount of water which roots contain, and the small percentage of ash, it has been maintained that they exhaust a soil less than the grains; that the potato and turnip may be grown without regarding very particularly the matter removed. In potash, however, the exhaustion must be admitted to be excessive, when the great amount of substance removed is taken into account. The nutritious matter of the root crops, which is derived ordinarily from an acre of ground, exceeds considerably that which is furnished by wheat, and rather more than that which is produced by Indian corn. These facts seem to show that really in the peculiar elements of roots their exhausting power exceeds that of wheat, corn or beans. These heavy root crops are usually fed to stock upon the farm, and hence there is no loss of mineral matter.

IMPORTANCE OF SUPPLYING PLANTS WITH PROPER FOOD.

Plants are not confined absolutely to certain kinds of food; their aliment may be varied, and they will preserve, externally, their natural characteristics, provided this variation is not excessive. It appears, from observation and experiment, that to a certain extent one element of food may be substituted for another; soda and lime, for example, may take the place of potash. It is not a matter of indifference whether tobacco and other plants contain lime or potash. It may not be necessary to follow the natural affinities of the plant; what we have to do is to ascertain the effect of these aliments on their qualities or properties. If the salts of lime predominate in tobacco its qualities are injured. It matters not whether tobacco is a potash or lime plant, in a state of nature, or has preference for lime rather than for potash; it is a fact merely, and by change from necessity, may affect the properties favorably. It is pro-

bably by a substitution of aliments that some water-plants, which are acrid and poisonous, become, in dry soils, mild, palatable and nourishing food. The properties of all cereals are somewhat changed by aliments, or by the soil, and it is possible to favor by cultivation the predominance of gluten or starch in wheat. But it should not be inferred that these changes are unlimited. Here is a wide field opened for analysis—the correct determination of aliments and their influence on the properties of plants, and the most effective means of imparting to plants the properties we desire, or rather I should say, to modify those properties so as to make them more useful to man. To do this will require an accurate knowledge of the composition both of the soil and plant.

The application of the precept of giving select food to the cultivated plants and fruits, as well as grains and roots, extends itself through the whole field of husbandry. The value of many, and perhaps all fruits, is very much diminished when they are produced upon certain soils, and their value greatly increased by proper food and culture. There is a great difference in the quality of uncultivated fruit and nuts. It has its application too to stock-growing and stock-feeding: the texture and flavor of meat is altered, in a sensible degree, by the quality of the food; pasture lands, by draining, become so far ameliorated in their grasses that mutton and beef is sensibly changed for the better. In the husbandry of this country these subjects are only beginning to receive attention. The field is interesting and important, but no one can successfully prosecute a refined husbandry who is ignorant of the composition of his lands, the wants of vegetables and animals, and the physiology of organized beings.

IMPORTANCE OF WATER IN THE ECONOMY OF ORGANIZED BEINGS.

It is a question whether water should be regarded as an aliment. Its importance can not be over estimated; and yet it is impossible to say whether it contributes to the matter of the cell. If the water was removed from the tissue of an organ, it would not be difficult to preserve the form and shape of the organ; air would distend and fill the cells and insinuate itself between the molecules. One of the important offices of water to organized beings, is to dissolve the elements. Water is the only agent which can separate the atoms of bodies, and so far divide them as to enable them to pass into the tissues of the body. I have already noticed some of the facts in regard to the amount of water in plants. By a reference to the table we may learn something of the importance of water, provided we admit that quantity is a test of importance. When we see that grasses and roots or herbage, in their growing state, contain from 70 to 90 per cent of water, we can not but believe that it plays an important part; it seems to be a solvent and a diluent: food, as has been remarked, must undergo solution; these solutions can not be concentrated. The constitution of bodies is such that nutritive matter must be dilute: when it is too much concentrated in the solution, it acts mechanically, and fills up the pores and channels of circulation. The remark is scarcely necessary that plants differ greatly in the amount of water which they require; and it may be true also, that some plants admit a more concentrated solution without injury. Water plants are exceedingly spongy and

loose in their texture, but at the same time there are animated beings, the sea nettle for example, in whose system the water is exceedingly great, consisting as it were of a sac of water, whose wall has the tenuity of the spider's web. The water is reduced to its minimum quantity in the harder woods, as the ebony, mahogany, and other plants which grow in a torrid zone; wood too, which has grown slowly in a temperate or frigid zone, is hard and compact. The principal uses of water, then, are reduced to two, solution and dilution. It may be added, too, that distension is another important use of water in the economy of living beings.

EXCESS OF WATER CONSIDERED.

When after a rain water stands upon the surface for twenty-four hours or more, the vegetation of those places will differ from the surrounding parts. A coarse and thin growth of the useless plants occupy the place of the valuable grasses or grains. The remedy for excess of surface water is draining. It is scarcely necessary to state, in detail, the mode by which this is effected; it is more necessary to impress upon the mind of the farmer the importance of the project. The clay lands are those which require this treatment; and some clays are more impervious than others; some scarcely permitting the rain water to penetrate at all, and others slowly. In the former case the standing water becomes green and filthy, and if extensive, its injurious effects extend beyond the plants which grow there. This stagnant water seems to be injurious rather than beneficial, for upon its margin, vegetation is less luxuriant than upon drier places. Although putrescent animal matters may abound there, one of the principal effects of standing water is to preserve a uniform but low temperature; hence, certain coarse grasses and plants which are fitted to such wet places, are the only ones which grow by them. The rationale of the process is simply the evaporation which must take place, but which necessarily abstracts caloric; and the operation being prolonged, the temperature can not rise, in consequence of the constant expenditure of caloric in changing the water into vapor. I have referred to one instance or case where rain water is injurious, from its inability to penetrate into the soil. This is a case which is entirely independent of the marshy condition, or from a springy condition which occurs upon sloping ground. From these remarks we may recognize a state common to each, which requires for its remedy one mode of treatment, viz. draining. These three conditions vary principally in degree. Where water stands upon the surface for a few days, after a rain, and evaporates into the atmosphere, the land may be tolerably productive; and so when the land is springy, it will produce grass, but generally it is unfit for cultivation or ploughing, and the grass is of an inferior quality. It depends much upon the excess of moisture during the season; in marshy ground the produce is objectionable, and generally worthless, except for certain kinds of timber. The remedy for each of these cases is one; but it is expensive, and the matter requires some calculation of cost before the cure is attempted: but the whole question may be stated in dollars and cents. What is the present value of the land, estimating its value by its present productiveness? Then the profits after the improvement. The expense may be calculated also; expense of ditching, of tile or of stone, and that of laying them down in a substantial manner.

I have stated thus much for the purpose of saying that draining should not be entered upon because it is the fashion in England or elsewhere, or because it is so much dwelt upon by theoretical writers. I have stated three distinct cases where draining will surely remedy the evil—the existence of too much surface water; and yet I say that it is, even in these cases, a question of time. The farmers of this country pursue their vocations for profit, and when a great and expensive improvement is in contemplation, it should be considered with reference to time, though the improvement can not be questioned. The building of a house is an improvement, and yet a prudent farmer will not enter upon that work till its cost has been calculated; the ability to meet the expense at the time, and the prospect in future of its remunerating the outlay. Fancy farmers, who have plenty of money, may do many things for the sake of doing them, or for the sake of falling in with the hue-and-cry of the day. So varied are the circumstances of the condition of the different parts of our country, and even of New-York, that it is not safe to lay down special and absolute rules, for the husbandry must be governed and controlled by those circumstances, or improvements made at times favorable for the execution of the project. There is no practice which is better established than that of draining, in the three cases I have mentioned, and yet the remarks I have made are founded upon principles equally just and true. Too much may be paid for a real improvement. If we were to follow the opinion of many writers, even writers of prize essays and lectures, from across the Atlantic, we should regard all the lands of New-York and New-England as demanding draining. What are the facts which have contributed to the currency of this doctrine? 1. The great success of draining in England and Scotland. 2. The large quantity of rain which falls in this country. Looking first at the effects and necessity of draining in England and Scotland, and seeing also that there are many places where more rains fall in the State of New-York than in England, the inference is very natural that the soil must be wet, and require draining also. But there is another element which has more influence, or as much as the quantity of rain which actually falls; it is a foggy atmosphere. Insular situations, like that of Great Britain, Newfoundland and Nova-Scotia must necessarily be obscured by fogs. A wind blowing from a warmer region to a colder, will condense the moisture it holds suspended—it is a law of nature. Evaporation from the surface scarcely occurs; and although less rain falls, still the condition of the country is such that it dries very slowly; less rain, therefore, will suffice to create a wet cold surface than where the state of the atmosphere is different. In New-York, even though the sum total of rain exceeds that of England, yet in consequence of the dryness and clearness of the atmosphere, our lands are comparatively dry and are not surface soaked and cold, as might at first be suspected.

To illustrate the differences of climate in regard to the quantity of rain which falls, I will refer to a few results which have been obtained, by which the reader will see England and Scotland in contrast with our country. In London and its vicinity the quantity of rain which falls annually is 23 inches; in Edinburgh, 24; in Liverpool, 34; in Manchester, 36; in Keswick, 76. In this country the quantity at different places, is as follows: New-York, 42 inches; Flatbush, L. I., 43; Jamaica, 39; Clinton, 38: the two first places is the average for 20 years; the last for 16 years. For Pompey, for 15 years, 29 inches; Cherry-Valley, 14

years, 40; Oxford, for 17 years, 36; Auburn, for 10 years, 34; Lewiston, for 10 years, 23; Onondaga, 30; Rochester, for 13 years, 39; Hamilton, for 14 years, 35; Albany, for 10 years, 41; Lowville, 30; Potsdam, for 17 years, 28. Portland, Me. 44 inches. The foregoing figures show that over the whole of our country the average quantity of rain is large, and yet large crops are produced. I believe the true rule of practice is to drain lands which are stiff from clay, and where water is disposed to stand upon the surface. Our climate being dry, the quantity of rain which falls, and which exceeds that of England or Scotland, is disposed of in all loamy soils where clay does not predominate. A farmer need not be in haste to drain lands which dry rapidly in the spring, and which admit of early ploughing, or soon after the snows have disappeared: that a wet soil, a marshy soil, one over which fogs linger for a long time, should be drained there can be no doubt.

For the reason, then, that our atmosphere is dry, and evaporation goes on rapidly, our lands do not call for draining to the extent which has been enforced by lecturers and essay writers. It does not follow as a consequence, that because we have much rain that the soil is necessarily wet, and therefore requires draining. Where draining is not required it must operate in the end injuriously, and therefore a loss will be sustained, greater than that which arises from the system itself. The rains which percolate through the soil hold in solution a small quantity of carbonic acid; this water, therefore, is competent to dissolve some of the valuable matters in the soil, which will consequently be lost. The land will be constantly leached, and, though the process may not go on rapidly, yet in the process of years a very large amount of soluble matter, in the condition fit for the food of plants, will flow off through the drain. The statement is made in view of analyses which have been made of drainage water. There is, therefore, no doubt of the statement that water which percolates through the soil, and then passes off through drains, is more or less charged with the nutriment of plants. If so, it is not a matter of indifference whether channels are constructed which will greatly facilitate this exhausting process. This side of the question should be examined. From the nature of the researches required to set the question at rest, some time must elapse, and in the mean time observation and experiment will increase our light upon a question of considerable importance to husbandry. When lands are wet there is one effect of draining which is of some moment, but which has not been dwelt upon by writers; it is the replacement, in part, of the water by atmospheric air. The air which penetrates below the surface, in increased quantities, performs important functions. Oxidation of the oxidisable matters must take place—the chemical change which soil and fine matters must undergo to fit them for aliments: this is probably one of the great advantages of draining. Admitting this, it is not to be inferred that all lands require ditching on this account. There is a certain quantity of water which the soil requires; and it is necessary that there should be the ability to retain water—to store it up for use during the intervals when the rains are withheld. During these intervals, it has appeared to me that there is an upward movement of the water; and that the upper layers of soil are supplied by this movement; that by this movement exhalation from the surface affects the rise of water to a considerable depth. In proof of a constant exhalation, I may cite the fact that when an excavation in the soil is

covered with boards, during a frost, the under surface is covered with congealed vapor : the source of the vapor is the ground, not the water in the boards, as may be proved by employing those which are perfectly dry. What takes place, then, during winter, takes place in ordinary circumstances during the summer. In order to promote this upward movement or circulation of water, we keep the surface loose and well hoed ; if this is not performed the surface becomes compact, or impervious, from induration. Water which rises thus from below is charged with inorganic salts, the aliments of plants.

One of the objects which I had in view in speaking as I have upon draining, is to prevent, if possible, unnecessary expenditures in this way, inasmuch as I believe that a large proportion of the farming lands of New-York do not require draining now : the same lands, it is possible, may be benefited in time or hereafter. It is an interesting subject for investigation to determine the effect of culture upon the texture and consistency of the soil ; whether moving it with the plough, and working it, may not effect changes in its condition which ultimately may require draining : if working it gives it greater compactness, such a remedy would be required in time. This, however, may not be a result of long culture. It will be observed that I do not disapprove of draining ; but I have taken the ground that there is less necessity for it in this country than in Nova-Scotia, New-Brunswick, Newfoundland and England, notwithstanding meteorological tables may show that a greater number of inches of rain falls annually here than in the places I have named. Our climate is eminently dry ; this is its characteristic. It arises partly from the general direction of our winds, which is from the north and northwest, or west and southwest. Blowing, as these winds do, over a vast tract of land, the moving air is deprived of its moisture. Northeast winds, which are loaded with vapor, are more common, I believe, between the months of October and April ; and hence their effects upon growing plants are not remarkable. We have a limited territory in New-York which may be regarded as an exception to the general dryness : for example, the vicinity of the great lakes is less dry than elsewhere ; it is, however, local.

ADDITIONAL REMARKS RELATING TO CLIMATE.

Having introduced incidentally the subject of climate, it may not be amiss to proceed farther with the same subject. The facts relating to the climate of New-York were treated of in my first volume. I regarded the subject as an interesting and important one. There are some general facts which I propose to state now. Latitude and height are the controlling elements of a climate ; but there are important modifying influences which should not be overlooked. Among these are the prevailing winds of a country. We see this statement illustrated by the westerly winds on this continent : these, as has been stated, are comparatively dry ; but westerly winds, in England, are charged with vapor. The position of a country, then, should be noted with reference to its relation to extended territory of land or sea. While we note, however, the fact that the westerly and northerly winds are dry, we also find that they are cool or cold, have a chilling influence on an early vegetation. The northeast winds being loaded with vapor, feel colder than the west and northwest, though more so than is indicated by the ther-

mometer. To the farmer it is important that he should have regard to the direction of the prevalent winds, and those especially which prevail in the spring: he will be governed by the winds in part in selecting sites for his buildings, and in planting his fruit trees; in the kind of fences and in their direction; and where it will be expedient to plant trees, and erect means for shelter and protection.

Another modifying influence is the vicinage of water. Two effects follow from water; first, a damp or vaporous atmosphere; second, equalization of the temperature of the seasons. The temperature is rendered cooler in summer, and warmer in winter, than it would be if land occupied the place of water. There is a very great advantage in this modification; frosts are not so sharp and destructive, neither the early or late; hence there are some vegetables which may be cultivated with success under these circumstances. This state of things favors a peculiar flora, and generally a rank vegetation. But it is not simply to a proximity to the sea that the whole influence is due; the waters are subject to movements, independent of the tides, which modify to a greater degree than can arise from proximity alone. These currents carry with them more caloric than that of the adjacent sea, but sometimes less. The effect of those warm or cold currents need not be described particularly. The warm current of the Gulf sets off from the Atlantic coast towards Europe, and as the prevailing winds are westerly they carry off the caloric to the east and northeast. Inside of this warm current a cold one comes down from the north, which is supposed to temper the heat of our southern coast, especially that of the Carolinas and Georgia. Local influences, both favorable and unfavorable to vegetation, arise from the shape and contour of land: but next to latitude, height is the most powerful agent in controlling the heat and cold, or rather the temperature of a place. A height of 350 feet is regarded as equivalent to a degree of latitude; of course this must itself vary with the latitude. In New-York it has been deduced by Prof. Coffin; yet it seems, from his observations as well as remarks, that it is variable. There are one or two facts deduced from Prof. Coffin's observations on the temperature of the State of New-York, which I have omitted to notice. It appears that central and western New-York enjoy a more equable climate than eastern or northern. The annual range of the thermometer is but 96°, while the range for the State is 104°, and that of the northern counties 120°. The greatest cold at Rochester, Lewiston and Fredonia, but little exceeds that of Long-Island; and vegetation in the spring is a few days earlier than the average of the State: it is about the same as at Albany. In central and western New-York we have an illustration of what a change of circumstances will produce in climate. Here there is a basin of water, though of but a limited extent, which is found quite influential on the climate of a large moiety of the State: a more humid state of the atmosphere is one of those changes; the immediate tendency of this state is perceptible in the spring, especially in creating a chilliness in the atmosphere, which retards vegetation a few days. But in addition to the changes which have been noticed, it has been found that the winds have about 11° a more southerly direction than for the average of the State. This is no doubt quite influential in modifying the temperature of this region: there is a higher elevation of temperature than is due to latitude or height; while in the eastern part of the

State the temperature is less than is due to elevation and latitude. Now it might be inquired whether the more uniform state of the atmosphere as to temperature is not due to geological causes, or more specially to its geological formations? I think not: we are to leave out height of course, which is due to a geological cause; we know of no facts which go to prove that a certain geological formation increases or diminishes the temperature of a region, aside from height and the relations which they may bear to water; that is, a slate or a shale produces the same influence in temperature that granite, gneiss or mica slate would, under the same circumstances. Besides, we know that there is a sufficient cause in the direction of the wind, and in the proximity to water, to produce the changes which have been noted. The rocks bear certain relations to water, which are always proper to notice; it is, however, the condition of the rocks, and not the mineral character, which is principally operative in producing a given result. Thus slate rocks, which have been pressed together in the upheavals which have taken place, become more impervious to water than if they had remained in a horizontal position. Limestone is frequently traversed by natural joints or cracks, which, in the course of time, have been widened, and hence water penetrates through the layers of limestone, and the soil resting upon the rock becomes dry. It even becomes excessively dry under those circumstances; or in other words, the soil is *too thoroughly underdrained*, and total barrenness is sometimes the result. This is the case of a tract of country in Kentucky, called the barrens, and it is a case which shows the possibility of lands being too much drained, and confirms the truth of the doctrine which I have desired to inculcate in some of the foregoing remarks on draining.

THE INFLUENCE OF CLIMATE ON PLANTS AND ANIMALS.

It is difficult to determine the influence of climate on organized beings. The influence of climate seems, however, to modify what exists; it spends itself in those bounds; it does not form, but modifies varieties. Light, no doubt, should be regarded as an element of climate; its duration and intensity are indications of its force and measures its activity. We see the foliage of a forest becoming more deeply green as we go towards a tropical region; the herbage of a species of forest tree becomes stiffer, rigid and less leafy as we go north, or ascend the mountains, and we may trace the changes in our ascent, until we find it a dwarf, a diminutive tree, a mere shrub upon the heights of a mountain, while in the plain at its base it is a lordly tree. Those changes are unquestionably due to climate; they are not those which characterize varieties, much less species. Indeed it is important that we do not assign too much to climate. Some naturalists have supposed that climate produces varieties; it seems, however, more consonant to facts to infer that varieties are independent of climate; that the causes which have been operating in the production of varieties have belonged to individuals. These forces or influences are begotten in a civilized state, or where many individuals are congregated.

It is not agreeable to the principles of natural history to maintain that the peculiar vegetation under a tropical sun is due to climate, or that it is an effect of climate. The species of plants belonging to the tropics differ entirely from the temperate; their characters are those

of different species, not varieties. When we trace the changes in a species of maple, as it approaches the confines of a temperate region, we may estimate the extent of change which is induced by climate. We can not compare dissimilar species with those which grow in the south, and say that their differences arise from the influence of climate, because those differences are specific—they should be different; and they may be greener, straighter and taller, because those characters belong to them. But climate has influences, but not the influences in kind by which permanent changes are continued and propagated by the usual modes by which individuals are multiplied, as by cuttings, grafting, layers or budding. Take off the pressure of a cold climate and the plant, which has been pinched and shrivelled, or dwarfed, will mount upwards, and spread itself under a genial sun. It is probable that climate favors the development of certain varieties more than others; indeed, there can be no doubt of the fact that varieties reach a higher state of perfection in certain climates than in others. If we study the habits of certain fruits, we shall find, and it is a fact well known, that they are very inferior, and even valueless in some climates. The plum is fine and very perfect along the Hudson river, but a few miles distant from it, it becomes inferior in quality. While, however, it is sufficiently manifest that varieties do not originate under the forces incident to climate, it is still difficult to point to causes which are directly operative in their production: it is, however, probable that a parental influence, those influences perhaps which are implanted for wise purposes, are effective in their development. Those species which are represented under numerous varieties, as the fruits and domesticated animals, have implanted in them a susceptibility to undergo those changes in their constitutions—it is in fact a part of their specific character; it is of a higher grade in some of the domesticated animals than others, and it is incident to those animals only which can be domesticated; and those which are easily domesticated have the power of multiplying varieties in the greatest numbers, and display the widest differences in the extremes. These views apply to man, who is more susceptible of change in his physical nature than any of the domesticated animals. Designed by the Creator to multiply and fill the whole earth, we find that his constitution is adapted to that end, to occupy all climates and adapt himself to a scorching sun or the frosts of a polar sky. Viewed in the extremes, the varieties in their physical characters present differences which are very striking; viewed however in their intellectual and moral aspects, the characters are those of a unity. Their power of speech and language, the conveyance of ideas by speech, is universal: this oneness of mind, which displays itself all over the world, the religious sentiment which is universal, point with significance to the singleness of the species. It must be so, or else man is an anomaly in creation. Those who have entertained the theory of a plurality of species, which in their aggregate, compose the human race, rely wholly upon physical characters to sustain their views. Considered even in this light, are the differences in the race so great that they would not have originated in the progress of time? Are the differences greatear than in the breed of dogs and other domestic animals, which naturalists admit are of but one species? In all cases those differences are external; they belong almost solely to the skin. If the bony skeleton is examined there are some differences it is true, in their proportions, but those differences are found in each of the races,

respectively. The blacks have not all the flat noses, thick lips and projecting jaws; there are whites with the same configuration of bone. But there probably has not existed a greater error in Natural History than in classing man with animals, notwithstanding the fact that in his physical organization he is not very dissimilar to them; yet, in the common classification, his least important characters are made the characteristics; whereas, really, his higher attributes, those belonging to mind, and his moral nature, should have been made the characteristics. If this view is correct, we shall be troubled no longer with perplexities and doubts about the question of the plurality of species, inasmuch as there is such a perfect uniformity in the characters of man in his mind, as to stamp the truth upon the heart of every candid inquirer. The thoughts of man are like one broad river; they flow in one channel; the speech of different races, which are widely separated, relate to subjects of the same kind; their belief in existence after death, of rewards and punishments, and all the strong castes of mind, move in one channel, and are harmonious in all their leading characteristics. Being destined to dwell on the earth for a season, it was fit and proper that he should, for that end, be furnished with what may be termed an animal nature; this nature belongs to the body, which is sustained, like that of animals, by food taken into the body, and air taken into the lungs—a transient habitation for an immortal mind. The end required an apparatus adapted to the circumstances of his existence, and to the surrounding medium: but to make that apparatus the all important part of his nature; to draw his characters from that, so transient, while mind, speech, articulate language, moral and intellectual attributes, religious sentiments, all of which are common to the races, does man great injustice, and is an outrage upon his nature. This uniformity of sentiment is proved by an intercourse with all the tribes of men. If there were two or more species, have we a right to infer that this uniformity would exist? Of all the species which live, or have lived, is there any thing like it in the whole range of created beings, that two different species have intellects alike, or an ability to communicate purposes, and intentions? If there are no cases of an analogous kind, it is plain that this uniformity of mental and moral views and feelings, and which are manifested in the same modes, should be taken as proof of the unity of the stock from which the races have sprung.

This subject is noticed cursorily, because it is one which is exciting a great interest; it is one of great importance, and it should be placed upon the right ground; and it is hoped that better and more correct views of classification should be embraced, than those which have hitherto prevailed; and if man is to be placed at all in a zoological classification, his characteristics should be drawn from his more essential attributes—his intellectual and moral nature. If this view is correct, then, our inquiries will be directed to those powers as they exist in the various tribes of men. If it is found that there is a want of uniformity in those characteristics, and if there is a specific difference in the reason of the races then there will be grounds for maintaining a plurality of species, and an origin derived from two or more pairs. Climate, when considered in its relations to plants and animals, may be regarded, as I have already had occasion to remark, as a modifier of the existing species and varieties; but its modifications are restricted and confined: it sometimes favors the more perfect development of varieties or species, and

sometimes it operates, in other locations where the climate is modified, to restrain development and perfection. Climate never intermeddles with specific characters; it may, for a time, obscure those characters in a monstrous growth, when aided by a rich soil, or by overfeeding. A problem of great importance may be solved by observing what products are specially favored by certain climates, and what climates are unfavorable to the production of the same. Where we have climate in our favor, and have not to contend with it, the expense of production is materially diminished; the certainty of the product is also increased, and its perfection secured, by which its value is also increased. As an element of climate the temperature of the soil at different depths is one of great importance The different soils may be said to enjoy different climates; those which are sandy possess a climate unlike that of a clay soil; a due admixture of sand and clay would combine elements which belong to a climate intermediate between the two.

In pursuing our investigation in regard to species and varieties, it is highly important that we should be impressed with the fact that specific characters are permanent, and it will appear, on reflection, that this is a beautiful and wise arrangement There is a fitness in the provision of individualizing species, as it were, both by corporeal marks and by intellectual and instinctive power. The intention or purpose which is fulfilled by this arrangement I do not intend to speak of now, it is the fact which I wish to bring before the reader. Many persons, however, when they speak of gradations of character, and of the intimate relations of things, and the links which bind all together, seem to labor under a fallacy. Where are those gradations seen, and what is the idea which is thus prominently set forth? What are the gradations of being? Is it probable that in the gradations which are insisted upon that there is any thing like a coalescence of species? I suppose that the phrase, gradation of being, is often used with too much looseness, and hence it frequently happens that confusion results from its use, and it undoubtedly arises from misunderstanding the nature of the changes which have taken place in some species, and especially those which are represented by numerous varieties. These varieties are never generic, but strictly specific. Take the apple, which runs into many varieties: those varieties all retain the characteristics of the species. No apple has been found yet which has made the least progress towards the pear; neither has the pear yet transformed itself, in any of its varieties, into an apple; each and every one of them are equally removed from the genus, and yet each branches out into hundreds of varieties, and no one has the least doubt to which species any one of the varieties belongs. The same is true of all other species. There is no upward or downward movement in this; there is, it is true, in the case of fruits, a difference in quality, but none of them can be said to have made any progress towards an allied species. The constitutive power to multiply varieties is only a part of their specific characters. If we turn our thoughts to the animal kingdom for illustration of the same principle, for example, we find the elephant is apt to learn, while the rhinoceros or hippopotamus scarcely possesses this aptitude in the smallest degree: the positive character of the first is as important, specifically, as the negative in the latter. If, then, by gradation of character, it is designed to convey the idea that species coalesce, by the resemblances in their varieties, the idea is erro-

neous: if, however, the phrase is designed to convey or express the fact, that in the system to which they belong, some species occupy a higher position than others, or that there are grades of development, some of which are high and others low, it is undoubtedly true. The position which a species holds is positive and arbitrary: species occupy a shelf or platform, which is fixed, and it neither inclines downward or upward; the position of the shelf, or in other words, the species is nearer one than another species, that is, a species more closely resembles certain species than others. Although the distance between neighboring species is unequal, still the two which are nearest akin never coalesce with each other through their varieties; even in vegetables, where they are susceptible of being engrafted or budded upon each other, there is no tendency to coalesce, or to produce an intermediate variety; the scion of the pear engrafted upon the quince is still a pear. There is, to be sure, a good reason for this, the pear is developed or formed in the cellular system, and really bears no connection with the quince, except by the sap, which flows upward and passes through the cellular system. The cells produced are only pear cells, yet it seems that if there was any tendency in the pear to become a quince, under any circumstances, the relation which the scion bears to the stock would be a favorable one. It appears necessary that a cell should be furnished from one of the parents, in order to produce an intermediate progeny, as is the case in the propagation of mules. But here we have unfailing test of the mixed parentage, from the sterility of the offspring, and although attempts have been made to prove the contrary position, still there is now no position better established than the one that the offspring of two different species of animals are sterile. It is true that, as in many other cases, there are partial exceptions, still two mules can not propagate a race.

Specific character is unchangeable, and species are kept, in consequence of this arrangement strictly apart. There is an application of this fact to the products of our fields, which by some farmers are supposed to undergo a change. Chess is a plant which has but a slight relationship to wheat, and yet the question has been discussed for years, and many intelligent men in other matters have strenuously maintained that wheat changes to chess; the change of course must be by a single leap, in a single season—a complete somerset, a perfect degradation of the species in a single period of growth. When and where does the change begin? The point which troubles farmers, is the appearance of chess where they have sown wheat, and clean wheat too. But it is also notorious to every observer that nature too has sown her seeds broad-cast, and that where there is land in a condition for seeds to germinate, there they will spring up; and it comes to pass from a wise provision, the tenacity of seeds for the vital principle;* and chess, while fond of a good soil, springs up by the side of fences and fields, and scatters its seeds, which lie in the soil till favorable opportunities occur for their germination. The fact that chess grows where wheat is expected is a trifling fact which is easily accounted for, on known principles, while the transformation of one species of plant into another is contrary to the laws which govern the growth and development of organized bodies.

* The phrase, vital principle, is used for convenience; it is not designed by it to express an opinion in regard to the independent existence of something which presides over the movements of living being.

The only point which can be cited, and which is at all analogous to what appears a transformation, is the reversion of domesticated animals to their original appearance or condition; as when the dog or hog is left to roam, and becomes wild in the forests, they revert back to their original condition; their original instincts returning as they become wild. Now if it can be shown that chess is the original of wheat, it might happen that where wheat springs up spontaneously and sows itself, it might in time become chess. But this hypothesis is unsupported by a single fact in the history of the two genera. The errors which have been entertained in regard to the transformation of wheat into chess, have arisen solely from defective observation. Chess is observed in a wheat-field, and becomes the more prominent and abundant when the wheat has been winter killed. Now it would be just as philosophical to maintain that the common wild cherry which springs up in our northern forests, where a wind fall has occurred and swept down the pines, that the pines were changed into cherry trees: these cherry trees cover the entire ground, and previous to the wind fall not a cherry tree was to be found. The seeds of the cherry, however, lay in the ground, and when light and air was admitted by the destruction of the old forest, they spring up and cover the ground. The occurrence is not strange, except in the great abundance of trees produced, and the occurrence of chess would not be regarded strange, if but few plants made their appearance; but when they become numerous, the question comes up, where did all the seeds come from? The case is one which is common; it becomes prominent only from the relation which the plants, wheat and chess, bear to each other: looking like a grain, in the midst of a grain field, being a hardy plant too, and springing up where it is not wanted, it has excited attention and imperfect observation, and in the end proving so worthless with its associate, it becomes prominent from its worthlessness. When we have ascertained the fact that seeds possess the power of retaining what is called vitality, for a long period; that they may sleep in the ground for years, and then subsequently awaken into life, by heat and air, or favorable conditions; that all this is true, and eminently so of some seeds, the fact of the appearance of chess in an old field, or in a field prepared for wheat, ceases to be a mystery. It is only a fulfilment of a law of vegetation; it occurs in obedience to the characteristics which have been stamped upon organized beings by the Creator, in order that the earth shall be clothed with verdure and not lie a barren waste.

It has been maintained that species have a tendency to rise in the scale of existence; that they may change their own proper natures and become something else. Such a view is analogous to that which prevails among farmers about chess, and has originated from defective observation, has its source and beginning from misunderstanding the relations of organized beings to each other. It arises directly from the fact, which has already been stated, viz. the closer resemblance which one species has to another than others of the same tribe. The pear has a closer resemblance to the apple than it has to the quince. The domestic dog has a closer resemblance to the wolf than the fox; and hence it has happened that the idea of an advance or change has taken a deep hold on the minds of some men; but there has been no change at all; not only are the species kept apart, but groups of organized beings also. Species, in their individual capacity, do not advance towards a higher, neither do they retrograde to a lower species. Plants do not deteriorate, neither do animals; but they retain all their specific characters.

There is another view which is interesting, viz. the manner in which domesticated animals break up into groups: it is illustrated in the dog, and all the domestic animals; but those groups retain the characteristics of the species, and of all the changes which take place not one affects the organization. The groups or varieties constitute well marked families, and are capable of preserving their identities as species. While species, as the dog and ox, possess a constitutional ability to change their external characters, which are not specific, the change itself is governed by a law which, while it marks the groups with characters transmissible to their offspring, still not one group, or an individual of a group, is merged in any of the near or remote species. I remark again, that specific character is never destroyed by external influences. In those instances where a species is changeable, and readily breaks up into groups whose characteristics are transmissible from the parents to their offspring, the specific character is never uprooted; and in fact these external changes should be regarded as belonging to the specific characters. It is true that this susceptibility can not be estimated or measured, as these changes are regarded as accidents, or occurrences which can not be determined by law.

IRRIGATION.

There are two kinds of measures which may be put into a systematic operation, for effecting a perfect irrigation. One is adapted to a field where there is a gentle slope, with a stream passing in a favorable direction, from which there may be sent numerous little branches, which may be turned upon it, and which may inosculate with each other and meander over the pastures or meadows. A gentle current is required, which should be directed through the enclosure in the least expensive manner, and the channel should never pass through hollows or depressions where the water will stand and accumulate. Means should also be devised for governing and controlling the water during excessive rains and freshets. A careful inspection of the ground is required, in order to secure all the advantages of fertilization of which this mode of applying water is susceptible. Another form of irrigation consists in flooding a piece of meadow-land at favorable periods, and over which the water may stand for a short period, and deposit the earthy matters which may be suspended in it. Nature in this case must favor the desired object. A stream must be dammed at the proper place, or at that point where its flow may be controlled. The water, on being elevated by the dam, will be made to flow in shallow channels, which also may lead into one main channel. With the proper arrangement the surface of the meadow may be laid under water, and let off at will. This project may be put in operation either in the spring or autumn, when the crops are not on the ground. The object in this form of irrigation is to supply, at a small cost, the fertilizers suspended in the water. The most favorable time for doing this is when the streams are swollen and turbid. The fertilizers, in this case, belong mainly to the mineral kingdom, and are durable though not active. This form of irrigation requires a careful survey of the ground, and a judicious system of channels and gates to control the flow of water. If the water is let upon the grounds during the growth of the crop care should be taken to avoid the deposites of the

coarser materials, which are capable of leaving a coat of grit upon the grass, as sometimes happens when meadows are overflowed in great freshets. The advantages of irrigation are very great, under favorable circumstances. Not only may their deposits of mineral matter in a state of fine division be formed, but river water contains a small amount of soluble salts, which supply food immediately to the crop. Besides this advantage the fields are partially independent of the ordinary rains; the crops may be advanced at an earlier period in the season, and the soil, instead of growing poorer annually, may in fact become richer. Very few meadows in New-England and New-York, which will not require a preparation of the surface prior to commencing a system of irrigation. Where there are depressions they should be filled, and brought to the general level of the surface; at least it is desirable to do this. Where much filling up is required the expenses will be too great, if materials are not at hand. Very few improvements can be sustained where a transportation of material by carts is required. It is rare that circumstances are sufficiently favorable to admit of carrying sand on to stiff clay soils for their benefit, or clay to sandy soils. In theory this mode of benefiting either kind of soil is often proposed, and the principle is correct enough, yet in practice it is too expensive; and so it is with many improvements which are proposed; they look rational on paper, and appear rational when discussed in farmers' clubs, yet in the field, where it becomes a business transaction and the dollars and cents are counted, these measures often fail, or are found unjustifiable from their cost; and no doubt, in this country irrigation may be found too expensive for our circumstances.

ON FERTILIZERS.

The farmer is compelled to employ a class of bodies to restore to his land those elements which he has removed in his crops. The soil is so constituted that at no time can it be regarded as an inexhaustible store house of food for vegetables. The matters constituting the fertilizers are inexhaustible, but their nature, together with their solubility, prevent large accumulations of any one substance, or group of substances, which are in a condition suitable for the nutrition of plants. These are slowly but constantly prepared from the rocks forming the earth's crust, and hence I have said the aliments which vegetables require are inexhaustible. When plants are cultivated, they take from this store house more nutriment than when they merely vegetate in a wild state: the seed and fruit, in the wild state, contain less of those expensive aliments. But the great reason why fertilizers are required, is in consequence of the removal of the mature crops from the fields, and their consumption elsewhere. Any thing is a fertilizer which can restore one or more of the removed plant-aliments to the soil. Of these bodies the most valuable are those which exist in the smallest proportions in the soil, as the phosphates of lime, magnesia, potash and soda, etc.; the organic salts of lime, as the crenic and apocrenic acids, silicate, and other salts of potash and soda. In all the facts relating to fertilizers we see a special relation and adaptation of the composition of the earth's crust to the constitution of the vegetable and animal kingdoms. Animals, though they can not feed directly on the matters forming the earth's crust, yet they feed no less in reality upon them.

When those matters have been combined in the bodies of vegetables they are fitted to become the food of animals; they are not absolutely changed into any thing else; there is a recombination of some bodies, and certain additions to the mineral substances which are derived from the vegetable kingdom. These organic bodies are formed by the union of oxygen, carbon, nitrogen and hydrogen, elements which play an important part in all organized bodies. Though these elements form constituent parts of the earth's crust, yet it would seem, from certain facts, that the vegetable kingdom is the field in which they are combined and prepared, and put in a proper state to become nutriment for animals; yet it is not by any means certain but the combinations may take place in the interior and exterior of the earth. First, there is an immense supply of carbon, from the carbonates of the earths and alkalies. The primitive limestone, which I have described in the volume containing a description of the rocks of the Second Geological District of New-York, and which was first brought to the notice of geologists by myself, in the reports for that district, is a rock occupying a position similar to granite, and hence must exist deep in the earth. Hence it is exposed to all those chemical agencies which are competent to decompose the rock and set free the carbonic acid, which in escaping can hardly fail to be brought to the surface. It will also form new combinations; it will be absorbed by water, soils, etc. Carbonic acid then may be supplied in the earliest states of the earth, and as carbon constitutes, in all vegetables, a very large proportion of their solid parts, it is essential to them; and however much may be required for this purpose, it appears from observation that the supply from the source I have named, must equal the wants of a kingdom. Carbonic acid, too, is continually escaping from the earth in some districts, showing clearly the probability of the position I have taken in regard to the carbonates in general, and the primary limestone in particular. Of nitrogen it may be said, too, that there is really no necessity for maintaining that its only supply is from organized bodies, inasmuch as ammonia, too, is a product of volcanic action, or of the chemical reactions which are constantly taking place in the interior of the earth.

Of oxygen and hydrogen it is scarcely necessary to attempt to point out the sources of supply, in any state of the earth's crust, inasmuch as oxygen forms a very large proportion of the crust itself, forming with all bodies combinations from which a supply for the vegetable kingdom might be derived. Water is one of the great sources of hydrogen; it is also a constituent of many other bodies, and hence the supply of the four organic elements, those which seem to be required to constitute an organ, could have been furnished directly from the interior of the earth, or from its surface, prior to the growth of a single vegetable; and the supply was great. Hence, too, it seems that the hypotheses of some chemists, in regard to the supply of vegetation in its first beginning upon the earth, of these bodies, are unnecessary: it is not necessary at least, to maintain that vegetation was scanty, and confined to a few of the lower tribes of plants, because fertilizers, those especially which constitute the main bulk of organs, could not be obtained. Other causes were in operation, which restrained the growth of vegetables of the highest order; for if we may form an opinion of the character of the vegetation of the early periods, it was mostly marine. Rocks of the Taconic System contain the first

organized beings; these are all marine. At the present time a large supply, at least of the four bodies, oxygen, hydrogen, etc., or the products of their combinations, are derived from previously existing organized substances. Although they have formed the organs—have been organized, we have seen that it is necessary that they should undergo a dissolution, before they can become again organized. The carbon of a vegetable, as it exists therein, is not suitable for an aliment, until it has been changed; it is neither fitted for a vegetable nor an animal—can not enter their textures and become a component part of their organization, any more than if it existed in the mineral kingdom, in some of its common combinations.

Fertilizers are divided into three great classes, according to the source from whence they are derived: 1. The mineral fertilizers: and 2. The vegetable fertilizers. 3. Those derived from animals. The first embrace those substances which belong to the mineral kingdom exclusively, as iron, lime, potash, phosphorus, etc. Those of the vegetable kingdom embrace certain combinations of carbon with oxygen and hydrogen, and hydrogen and nitrogen. It will be observed at once that the foundation for this division of the fertilizers is very slight, in reality, inasmuch as each of them belong to the mineral kingdom, and were derived originally from that kingdom. But the vegetable manures, as well as animal, have undergone transformations in the tissues, and hence may, for the sake of convenience, receive the denominations in common use. The organic fertilizers have usually been subdivided, into those which belong to the vegetable and animal kingdoms. There is one substance which is not properly ranked among the manures, but may, with propriety, be denominated a fertilizer: I refer to water. Of its importance, and of its injurious effects when applied in too great abundance, I have already spoken: such is the constitution of every kind of matter which lives and grows, that it must be supplied. It is unnecessary to dwell upon the mode or means of applying water. Irrigation may be resorted to in all those places where a stream has a sufficient descent, or where it flows over moderate slopes. What is necessary to secure the good effects of water, in irrigation, is to give as moderate a current as possible: it should not stand upon the surface and become stagnant, neither should the surface be made too wet where it does not accumulate. Advantage should be taken of streams flowing through meadow and pasture lands: small streams flowing out from the main stream will materially increase the value of the land. The water of the road gutters also should be turned so as to flow, if posible, upon the pastures or meadows.

Previous to entering upon the detailed consideration of manures it is necessary to observe that the effect of manures and fertilizers will depend much upon the annual average quantity of rain which falls upon any given place; if the place is dry, comparatively, the effects of certain kinds of fertilizers will be greatly modified: guano, in a dry season, will be lost nearly. Artificial fertilizers, similar to Liebig's patent manure, will also fail, in many places, for the same reason: hence it is that great diversity of opinion exists in regard to their value. A season may favor the use of one fertilizer, and at the second application fail; another may fail from either, an extraordinary dry or wet season: hence, too, the necessity for a careful investigation of the character of the seasons as to water, heat and cold. The first volume of the Agriculture contains many facts on these subjects, which may be applied to some useful account

by the intelligent and inquisitive farmer. Memory is not a sufficient guide in matters pertaining to meteorology; it is necessary that observations should be recorded, and that the result of many years should be taken in order that the mean or average quantity of water which falls, the direction of the winds, the number of cloudy days, etc., may be determined with accuracy. A large proportion of this state has been settled within the memory of the oldest inhabitants; the forests have been cut down, water courses have been drained, and it is only within a comparatively brief period that the surface has been brought into a state which may be regarded as permanent. These changes upon the surface may not influence the annual amount of rain which falls generally, yet I believe that some sections of country may be permanently affected; the amount of rain will be less than when in forest, and it is possible that the manner of its fall will be changed also. A rain falling in torrents will produce upon the face of the country an effect unfavorable to vegetation; there may be less regularity in the spring and fall rains. The temperature, taking the seasons together, may be modified. All facts which bear upon these points require to be collected, inasmuch as little dependance can be placed upon the isolated experience of individuals, especially where the opinions are formed from memory.

I. The fertilizers which belong to the mineral kingdom.

It is to be remembered that any thing may be regarded as a fertilizer which is found incorporated into the vegetable tissues; but some of those substances are of less importance than others, for the reason that nature has supplied them in sufficient abundance. The soil always contains a quantity sufficient to meet the wants of vegetation. Of these substances it is probable that iron and manganese are always present in quantities sufficient to meet all the demands of growing plants, and rarely, if ever, suffer from their absence. How this fact may prove in chalk districts, where there is truly a calcareous soil, I am not informed; but clays, sands and loams, in all their varieties and mixtures, invariably contain iron sufficient to meet the demands of plants. The condition of the iron, however, may not be that which favors, to the greatest extent, the growth of vegetables. It is proper to observe, however, that there are occasionally indications, in fruit and forest trees, of the want of iron: they become yellow and sickly. In this condition, the oxides of iron from the smith's forge, cinders, etc., applied about the roots, will restore energy to the feeble plant, or even when the leaves are sprinkled with a solution of a friendly salt of iron, the reviving effects often speedily follow. These cases may be regarded as exceptions, and seem to be cases where the plant remains in situ many years, and where the roots may be unable to penetrate into a new soil. Manganese is often detected in the soil, and perhaps is always present; its utility to growing plants has not been determined: it is common in the ash of corn stalks and corn leaves. It would be unsafe to maintain that it is useless because it exists only in small proportions, and is absent in many instances.

1. *Fertilizers in which lime is one of the constituents.*

It would not be proper to designate the large number of compounds in which lime is a base, under the name of calcareous manures. Some of them, as quicklime, marl and plaster, are

frequently spoken of as calcareous manures; but there are others, as the chloride of lime, nitrate of lime, phosphate of lime and silicate of lime, which are never spoken of under this designation. In each of these compounds lime is the base; and in each it is probably quite essential to the effects which are produced.

The most common form in which lime is employed as a fertilizer is that of a subcarbonate, or partially slaked lime; in this state it still retains a slight caustic state, but is not burning and pungent. Lime, when first taken from the kiln, is caustic, and in this condition it is too active to be employed in agriculture; it should be exposed to the air and allowed to absorb carbonic acid and water. During this exposure it swells and falls to a fine powder, and loses its sharp causticity. If used in the condition in which it is first taken from the kiln, it destroys the vegetable tissues, from its strong affinity for water; it is too drying, it should, therefore, be partially saturated with water and carbonic acid: it increases in bulk, during this absorption, to the amount, that one bushel will measure, after absorption, at least five pecks.

Much has been said of the modus operandi of lime, and many opinions have been advanced as to its value. When we know that lime is one of the essential constituents of plants, we can have no doubt that one of the most important functions of lime in the soil, is to supply this element to the plants directly; and I think we may be satisfied that it is a nutriment, and enters the tissues, as an essential part of the internal skeleton. No plant is destitute of lime; but in the bark or outside it exists in its maximum quantity. But besides this, some trees, as well as plants, contain, as a whole, a much larger proportion than others: compare the analysis of hickory with the white and red elm, and it will seem that lime is much more abundant in the former than the latter. It is scarcely possible to manufacture common soft soap from the ashes of the hickory, in consequence of the want of potash and the predominance of lime. In what form lime is received into the roots of plants is not yet made clear, by well conducted experiments. It is, however, probable that the carbonate or subcarbonate is decomposed in the soil by an organic acid, as the crenic and apocrenic acids, which are generated in the soil from vegetable matters, or from the decomposition of leaves and roots, and organic matters in general. These matters absorb or combine with oxygen; or in other words, they undergo a slow combustion: and here I may remark, though the subject has been under consideration, that in order that these vegetable matters may oxidise, dryness of the soil is required. When, for example, they are saturated with water, they become peat; if the soil is drained of water, the capacity of the soil for air is increased; it replaces the water, and hence the amount of oxygen in the soil is increased, and combustion or oxidation is more perfectly performed.

But to return to the consideration of lime. Lime, when added to the soil in the condition I have stated, carries with it carbonic acid. This will be set free, provided the organic acids are present in the soil. When free it acts with considerable energy on compounds which contain phosphoric acids; and it may, therefore, be regarded as an active agent in the decomposition of many bodies in the soil, or in forming new combinations; or it may be dissolved in the water of the soil, and be absorbed by the roots of plants. But another effect of lime, especially where clay predominates, is to decompose the silicates of potash and soda, which

are common to argillaceous soils. This fact is explained in the usual language, by saying, that lime has a stronger affinity for silica than potash. Another perceptible effect of lime is to change the physical condition of argillaceous soils; they become by its use porous and light.

If the foregoing remarks are true, it appears that lime must become, in this country, as important to farmers as it has become in Europe. Its effects are often remarkable, especially upon lands which have been long under the plough. Probably the effects of lime are more perceptible in Maryland, Virginia, and other southern States, where maize, wheat and tobacco have been cultivated and manures neglected, than in New-England and New-York. Notwithstanding the facts stated may be regarded as fully substantiated, still it happens that lime is apparently useless; hence some agriculturists regard lime as of little value. Its failure it is evident must arise from the sufficient supply of lime in the soil; no other reason can account for its failure, for it is required by all cultivated crops, and if a crop does not appear benefited it is clear that it does not want lime. It is not injurious; it will be wanted in time; it will not be lost in the end, but now its good offices do not appear. It is supposed, by some physiologists, that lime, to be beneficial, must come in contact with organic matter in the soil; hence, if no organic matter is present, it remains comparatively inert. Organic matter undoubtedly aids materially the immediate and visible effects of lime upon a crop; still where potash exists in combination with silica, it will not fail to decompose this silicate.

What are some of the ultimate effects of the use of lime? Reflection on this point will lead us to adopt the following conclusions: lime increases the products of the field, and from the conjoined effects upon it, it is plain that a larger quantity of phosphoric acid, of potash, soda, and of organic matters, are used than if lime had not been employed; the consequence plainly follows that, where no other fertilizer is employed, the soil is more rapidly exhausted, and hence in time, sooner or later, according to the quantity of nutriment in the soil, the effects of liming will be seen in the diminution of the value of the crops. The land is evidently impoverished. Is this an objection to the use of lime? Certainly not; but the use of lime, by itself, is objectionable, if persevered in; the system is not the best. Where we are satisfied that potash may be obtained by the use of subcaustic lime, it is a profitable employment of it; but it should be followed by other fertilizers, in a compounded state, those from stables particularly. Such a course would be pursued, were it it not for the fact that the land produces so well that nothing more is required; and hence, setting experience aside, there is no call for other fertilizers, until indeed the land itself proclaims its wants, by refusing to give the ordinary crops; and it is not to be regarded as strange that, even then, those calls are interpreted wrongly, for considering how lime has increased the fertility in years past, it is quite probable that the farmer may infer that more lime is called for, and more is added, followed with increasing injury, the stock of the other aliments being reduced still farther by its operation. Land which has been thus treated, is not renovated at once; but time and judicious treatment will restore the soil to its former condition.

From the foregoing remarks and facts, as stated, farmers will not resort to the use of lime, without first satisfying themselves that lime is wanted, or that the soil is deficient in this ele-

ment; and here the inquiry very properly comes up for consideration, what amount of lime is sufficient for all ordinary purposes? It is less than is usually supposed by farmers; one per cent of lime is enough, if we may rely upon the products of a soil which does not contain more than that quantity, for it is true that soils, where no larger amount than this is found, yield fine crops; when reduced to one half of one per cent, it is not really discerned in the diminution of the products. We have no calcareous soils in New-York or New-England, except in very limited areas. The limestones, as they occur in this country, are hard: the dolomites in the Taconic system and limestones denominated primary, are often friable, hence the debris is spread a few yards, and forms a soil composed entirely of granulated limestone.* But the soil directly upon our principal limestones rarely contain two per cent of lime. Our limestone soils are good, but not because they contain lime in so much greater abundance than other soils, but because their structure favors, usually, their drainage; they are usually loam soils, especially where the limestone is dark colored. We are not to infer that, because the soil is based on limestone that it is a calcareous soil, which seems to be the common opinion of our farmers.

To conclude, lime is an aliment of plants, and is required as such; it supplies, in its subcaustic state, carbonic acid, another element of great importance. Carbonic acid is an efficient solvent of rocks containing phosphoric acid and the alkalies. If the acid is set free, it may be dissolved in the water and absorbed directly; and it may also act as a solvent on the particles composing the soil, and enter thereby into new combinations, and become, in these forms the food of plants. Lime sets free the alkalies by decomposing the silicates of potash and soda.

Lime should, in general, be laid on soils in combination with organic acids, or in the form of compost; layers of weeds, straw or turf, alternating with the refuse matters which may be collected, both animal and vegetate, and sprinklings of lime. In these artificial forms it seems to be converted into the food of plants; it is at least in a condition which is required. But when it is designed to effect important changes in the soil itself, as the liberation of the alkalies, caustic and subcaustic lime is necessary. The quantity of caustic or subcaustic lime which is regarded as suitable, per acre, is not definitely settled. Two views on this question have been taken, and hence two plans have been adopted; the first is, to lime heavily, and employ it only at long intervals: on this plan 250 to 300 bushels of quicklime are allowed, per acre, where the lands are argillaceous; if the soil is siliceous 150 to 200 bushels are used. But the second plan admits only from 60 to 70 bushels, per acre, at intervals of seven or eight years. This

* I deem it highly important that this statement should be repeated here. I have made the same elsewhere in this work; still writers frequently speak of calcareous soils, as if they had a real existence in this country. The statement is important, because real calcareous soils may be, and are treated very differently from other soils: for example, the astringent salts of iron may be employed with fine effects on a calcareous soil. Now this salt of iron, (the proto-sulphate of iron) is especially injurious to vegetation. Where lime, however, is abundant in the soil, this poisonous salt is decomposed, the sulphuric acid leaves the iron and combines with the lime; and hence a valuable fertilizer is at once formed in the soil, accompanied, as in the instance I have before stated, with the disengagement of carbonic acid. This is only one instance where a calcareous soil may be treated in a mode entirely different from any other kind of soil. Any of the New-York soils treated thus would be injured materially, and would not recover from the injury for years.

is the mode which is recommended and followed in France ; while in England, the first method is recommended and is employed at intervals of from fourteen to sixteen years. It is evident, when the amount of lime is added of from 250 to 300 bushels per acre, that more is applied than can be taken from the soil by any kind of rotation of crops, for the periods named. May not even a less quantity than the smallest here named suffice, and answer all the purposes which it is possible for lime to accomplish ? Less capital will be required, which is an important consideration, especially in the farming districts of this country. The differences in the character and quality of the lime itself should not be lost sight of. Oyster-shell lime, or shell lime as it is called, as well as the hydrated subcarbonate, is bulky ; is less caustic and less active by far than stone lime : twenty-five bushels of stone lime from the kiln is fully equal to fifty bushels of shell lime, as usually found in market. Shell lime may be purchased for five cents per bushel, while stone lime is worth from sixteen to twenty-two cents. So far as adding lime, as a simple fertilizer, to the soil, the shell lime is the most profitable ; but the stone lime is more profitable, provided it is employed upon a stiff clay soil, and the principal object is to break up the clay and liberate potash.

The time for putting the lime upon the soil is not a matter of indifference. If added in a caustic state, in the autumn, and well incorporated by the plough and harrow, the whole effect of the lime is secured. For thorough liming, the autumn is the proper time, after the sod is turned over, when to finish the operation it is to be incorporated by light dragging. Lime has a tendency to sink into the soil, and hence there it will find its way to the roots of the crop. Lime, when used as a top dressing, should be fully air slaked, or only its mild form ; when thus used, it is designed mainly to supply the crop with a nutriment : lime, in this condition, is remarkably well fitted to fulfil the ends for which it is used ; its extreme fineness, its sparing solubility withal, are qualities which favor the use of this substance.

The soils of New-York, as a whole, are deficient in lime. The new lands, though they are not apparently benefited by it, still no injury will result from its use. It is not, however, profitable to lime light soils, unless it is combined with other fertilizers. The southern district of New-York is destitute of lime, and probably the lands require it ; analysis indeed proves this. The northern district, particularly the interior, is also deficient in lime. There is, however, a prospect of a supply in the primary limestone, which, though often impure, yet when magnesia does not abound in it, will answer a good agricultural purpose. Pulverized limestone has been occasionally tried as a fertilizer ; but it has the disadvantage of being comparatively coarse, and the experiments have been made upon lands in which lime probably existed in sufficient quantity to meet the wants of vegetation. Pulverized limestone, under favorable circumstances, will operate only slowly. It can hardly be doubted but that its effects must be useful, though not very evident : it is the condition in which lime actually exists in all new soils. We can not expect those effects which we witness in quicklime.

Another variety of lime should not pass unnoticed : I allude to marl, a substance identical in its composition to many of the limestones. The property which gives marl its superiority to pulverized or ground limestone, is its fineness. We can hardly give credit to the view that

its composition gives any advantage over other carbonates of lime, especially over the shaly and other comparatively impure limestones. They all contain organic matter and phosphoric acid. Marl may be used to any extent and upon any soil, and it is especially adapted to sandy soils. Marl has one property which is extremely important: it has an affinity for water, exceeding even clay, and hence it is that on our sandy soils it may be used profitably; and besides improving the character of the soil, chemically, that is, adding an element which most sandy soils require, it also increases its retentiveness. The Albany clay, which has sometimes been called marly clay, from its containing lime, will be benefited the least by marl of any variety of soil in the State; it comes the nearest to calcareous soil of any kind in the State; it contains all the lime which is essential to fertility, and the only form of lime which will operate decidedly upon it is caustic lime, and this has often failed, and failed because there is enough in it. Even the stiff blue clay is calcareous; this formation extends through the State, from north to south, and also lines the banks of the St. Lawrence; extends up the Mohawk valley, and is clearly recognized in the interior of the State, or many of the higher valleys of the southern counties. The effect of marl upon many crops is quite decisive; on potatoes the yield is greater and the quality is improved. In fine, marl should be regarded as one of the most important fertilizers, being adapted to a great variety of crops, and is not liable to abuses, or to produce ill effects from a free and continued use. It often carries with it organic matter, phosphoric acid, iron and soluble silica. The position of marl is below peat beds, formed in isolated basins of quite a limited extent. The eastern counties, or those east of the Hudson river, furnish marl and peat in small basins. In Middle and Western New-York, both are more abundant, and occupy wider areas. In fact Middle and Western New-York contain inexhaustible supplies of both substances. Both lie unemployed and useless; but the time is not far distant when they will advance in value, and be regarded as the most important formation in the State, iron excepted.

Another formation of some importance is the beach marl, found upon the coast, where sea shell is mixed with various materials, as sea weed, sand, animal matter, etc. Decided effects have followed from the use of beach marl, even when the sand is strikingly predominant. Remarkable effects were noticed by President Hitchcock, on Cape Cod, where beach sand was transported to the sandy beds of a garden. The microscope revealed comminuted shells in the formation; to the eye, unassisted, it is usually sand. Formations of this kind exist upon our coast: of course they are local, and merit only a passing notice. They however fully prove the value of comminuted shells, which may be turned to profit in cities, by using the oyster and clam shells. Pulverization may be promoted by a partial burning in a cheap kiln. One of the best uses which shells can be put to, is to apply them to our clay soil; if coarsely pulverized they will change the physical character of the formation and convert a stiff, close soil to a porous one. A cheap and simple mill for cracking them is certainly a desideratum.

We have as yet no statistics by which we may learn the increase of products from the application of the different forms of lime. We are not, however, wanting in statements which go to prove that its application has been followed with little or no increase of products. To an-

swer the objections which these failures raise to the use of lime, it is only necessary to ascertain that lime existed already in the soil, and that poor crops in those cases of failure arose from other causes than the want of lime. Analysis of the soil is the only safe test to go by. If a soil is found destitute of lime, and is not benefited by its use, it will go far to discourage its application in a great variety of cases. But such a result is not likely to happen, so true are the principles which govern the composition of all bodies. The crops upon which lime acts with special favor are the cereals, as a class, and all fruit trees. For wheat it is used, or should be applied previous to the sowing of the seed, in its caustic or subcaustic state, except when it is used as a top dressing. For maize, it should be composted and put in the hill. For trees it may be applied in its caustic state, or it may be composted. This subject has only recently arrested the attention of farmers. Fruit trees, although sufficiently esteemed, yet the idea that they might be in a starving condition, scarcely entered the heads of fruit-growers. Analysis of the parts of a tree show that lime is one of the special elements required. All parts of the tree contain lime; and as the tree may have been planted in a soil poor in lime, it is not improbable that its developments have been restrained for want of this fertilizer.

An idea has often been thrown out, in books that certain soils were sour and required to be corrected, as doctors often correct a sour stomach, by administering an anti-acid. One of the indications of a sour soil, according to the view of many is the presence of sorrel, (*Rumex acetocella.*) This sour soil theory, however, is not so prevalent as formerly. It had its origin in defective observation. Lime has been always prescribed for this condition of the land, and with apparent favorable results: thus where sorrel has abounded, a fine crop of wheat or maize has been obtained, and the sorrel has disappeared. In these cases, however, it is evident the sorrel has not disappeared because the anti-acid has been applied, but because it has been overcome and subdued by a more powerful neighbor: that it is not subdued directly by the chemical operation of the lime, by the neutralization of an acid of the sorrel, is proved by the fact, that sorrel will grow with the greatest luxuriance in the midst of lime. It may always be seen in the immediate vicinity of limekilns, and growing in the refuse lime. The growth of other plants, no doubt, crowds out the sorrel, in all those instances where liming has been employed to correct what is familiarly termed an acid soil. Even the existence of an acid soil remains to be proved; it is really, on the face of it, an error—not a very serious one, it is true, but still an error. The only condition which favors the development of an excess of acid, is a mixture of vegetable matters in the marshes, where earthy matters are most absent, and if present, only a slight sprinkling of sand. But this is not soil, properly speaking: no arable lands are ever sour, or require the kind of doctoring which the language expressive of their condition would require.

Gypsum, (*Sulphate of Lime.*) Gypsum has been used as a fertilizer more extensively in New-York, than any other species of mineral of which lime forms the base. Being one of the common rocks, and easily accessible in the formation to which it belongs, it has become one of the common fertilizers now in use. Experience has proved its utility, and the most profitable mode of employing it. Gypsum is composed of 41·5 lime and 58·5 of

sulphuric acid; or, the hydrous gypsum is composed of sulphate of lime 79·2, and water 20·8. The latter is the species of gypsum employed in agriculture. It is met with under a variety of forms, as in transparent lamina called selenite, and not unfrequently considered as isinglass, and regarded as worthless; also in columnar forms, both fine and coarse, and of a variety of colors. The common form is that of a coarse gray rock, with a fine granular texture, and destitute of lustre or beauty. The rock is easily recognized from all other rocks by its softness, except some of the magnesian rocks, as soapstone, steatite or talc. The geological position of a rock suspected to be gypsum will often be sufficient to determine the fact whether it is this substance or not. Thus gypsum never occurs in primary rocks, or in any way is it associated with them; hence any specimen which is known to have belonged to a primary district, furnishes sufficient evidence against its being gypsum. In New-York it occupies a certain geological position among its sedimentary deposits, though gypsum occurs elsewhere in the sedimentary series in other sections of the country. Gypsum is tasteless; it is sparingly soluble in water; 400 grains of water dissolving one grain of the mineral. The history of gypsum as a fertilizer is interesting on more accounts than one: it shows on what slender grounds a valuable substance is opposed; sometimes the opposition arose from selfishness alone, as noticed by Boussingault; in other instances the friends of gypsum injured their cause by exaggeration of its value and effects. It was often regarded as a universal improver of soils, and capable of supplying the place of all other substances: experience, however, in time, proved the contrary, and it has happened, as in many other instances of a like kind, reaction followed, from which its properties were as much underrated as they had been before exaggerated, by its friends. Besides the unfavorable influences growing out of misrepresentation, there were substantial facts which militated against gypsum though they were rather of a negative character. It was found, by experience, that there are some crops upon which gypsum failed to produce perceptible influences; and there were, too, conditions accompanying its application, which also rendered it inert and useless. Thus it was proved, and it is confirmed by modern experience, that it does not operate usefully upon wet meadows; neither does it increase the product of wheat when directly applied to it. Besides the foregoing facts of an unfavorable charcter, there are sections of country upon which it never operates decidedly at all; Long-Island, for example. The testimony in regard to its use is generally of a negative character; and it is quite difficult to assign a reason for its general failure here, though it has been supposed, by some, that there is in the soil a sufficient amount of gypsum to answer the purposes of vegetation, though it is not established by analysis. So it has been maintained that proximity to the sea renders it inert: but the proximity to the sea is only a fact which, when really scanned, can have but a remote bearing on this question, unless it can be proved that lime, in some way or other, may be derived from a marine atmosphere. There are instances upon Long-Island, however, where gypsum has operated favorably, and hence the proximity of the sea is not always operative as a preventive. The probability is, in the case of Long-Island, there are other elements wanting in the soil besides lime or gypsum; and hence, as it is incompetent to supply those other substances which are

wanting, its failure is readily accounted for on this supposition. If a soil is destitute of lime and potash, the addition of calcareous matter will not restore fertility, and the effect would be imperceptible. Facts seem to prove that the soil of Long-Island is destitute of the alkalies particularly potash; on this view of the matter, the failure of gypsum is rationally accounted for.

Time when gypsum may be laid upon the soil. Experience proves that the spring is the most favorable period. It may be sown upon a soil after or before the seed is sown; or it may be sown upon the crop after it has appeared above the soil: the weather should be dry, but many prefer to sow it just before a rain. It is applied directly to hoed crops, as potatoes and maize. To render gypsum useful to wheat, it is never applied directly, but to a clover crop which precedes the wheat. It is, therefore, apparently indirectly, but really directly useful to wheat. Clover, as I have before observed, is both a lime and potash plant, but plaster is particularly beneficial to clover; it is a fact supported by observation. The clover in this way furnishes the potash which the wheat requires, and which it does not seem capable of doing itself, directly; it is constitutionally impossible for wheat to get a supply of potash, except in newer grounds, without artificial aid. Phosphoric acid is another substance which clover furnishes, and is made available to the wheat crop which is to succeed it.

The increased products arising from the use of gypsum, have been repeatedly determined by direct experiment. Allowing for the variablity of the seasons, or the liability to partial failures from drought, it has been shown that plaster, in an ordinarily favorable season, increases the product to twice its amount. This increase, however, holds good only in the case of clovers—the white and red. Admitting that the increase is less, the use of gypsum is still important. The influence of gypsum is not entirely dependent upon the rains of the season, inasmuch as it has often been observed that where clover appeared feeble, and plaster has been applied, the good effects of it have preceded the fall of rain. No doubt the evening dews were sufficient to dissolve and furnish plaster to the roots of the growing plant. While the general effects of plaster have been acknowledged, there is, and has been, a want of unanimity in regard to its mode of operating; or different views have been taken of its action. Of these views only three appear to be important, and indeed it will not be absurd, even if we choose to maintain that each and all of them are right. Sir Humphrey Davy maintained that gypsum entered into the constitution of the plant, or its tissues, or is an essential substance in the chemical constitution; hence it becomes, according to this view, an aliment in itself, and in its own integrity, without undergoing decomposition. Liebig maintains, on the contrary, that its effects are indirectly obtained; that it first absorbs carbonate of ammonia from the atmosphere, which it fixes, undergoing at the same time decomposition itself, by losing its sulphuric acid, which goes to the ammonia, and forms with it sulphate of ammonia. Experiments conducted under favorable circumstances, prove the chemical changes which Liebig asserts. Gypsum in a stable removes at once the smell of ammonia; and analysis of it subseqently proves the changes it has undergone. Boussingault is inclined to take a third view of the question, and maintain that clover and other plants, whose growth is so much promoted by gypsum, obtain sulphur from and by decomposition. Now, to a certain extent, each view is undoubtedly correct.

Gypsum is found in the ash of plants; this fact supports the view of DAVY. Gypsum absorbs ammonia, and when this takes place, as it will to a certain extent in growing plants, it will fix and furnish ammonia to the plant; and this favors LIEBIG'S views, and they are certainly rational. So plants possess the power of decomposing the salts received into their tissues, and there is very little reason for doubting the effect of clover, and sanfoin, on the sulphuric acid of the sulphates; that they do separate from the oxygen and combine it with another element, in some way not well understood; and hence BOUSSINGAULT'S view also is, or may be true. At any rate the three theories are partial and do not cover the whole ground; all are defective for want of fullness, and hence only partially true, and true only as far as they go; neither of them is false. BOUSSINGAULT takes a very rational view of the favorable effects of gypsum: he regards its sparing solubility as an important feature in explaining its effects. A gallon of water dissolves about a quarter of an ounce of the sulphate. Now plants require, and indeed take up with reluctance only small doses of mineral salts, and their capacity for taking up and appropriating them is necessarily limited; hence the economy of plaster, as only a small quantity is dissolved at one time—just that proportion which the constitution of the plant demands; hence, too, its value is prolonged, and its good effects visible for several seasons in succession.

Phosphate of lime. The constitutions of animal bodies require this salt: it exists in the blood, in muscle, in albumen, casein and most of the fluids, milk, cream, etc. Its importance to the animal, and indeed to all organized bodies, has been dwelt upon sufficiently already. The composition of the bodies just mentioned, is given in the second volume. Phosphorus as a simple undecompounded body, does not exist in nature; its properties forbid this: hence it is always found in combination with other substances, lime, iron and alumine, and in the tissues of vegetables and animals, with soda, potash and magnesia. The most abundant salt of phosphorus is phosphate of lime; it is a native mineral, and found in New-York imbedded in crystals, in a peculiar limestone, denominated primary limestone in my Report of the Geology of the Second District. The crystals are six-sided, usually green and greenish white: the largest which has ever been seen is twelve inches long, and weighs nineteen pounds. Phosphate of lime is also associated with magnetic oxide of iron; a fact which I first made known in the volume just referred to. It was, however, known to occur associated with some of the ores of iron, but had not been recognized in distinct crystalline masses of a large size. Another form of this mineral is that which was also described under *Eupyrchroite*: it is in mamillary masses of a dark green color, annexed to a trap dyke, resembling the ordinary dykes of greenstone. This association is an important fact, and taken with other facts, its association with primary limestone and lava, and iron ore, point to an igneous origin. Igneous rock, too, as has been proved by FOWNES, in his well known prize essay, is contained in the decomposing granites, porphyry, trachyte, etc. It is, therefore, highly probable that a supply of this substance is to be sought for in the igneous rocks. The basis of the globe furnishes this substance to the soil; it finds its way to the sea, and is there a food for fish. The trap dyke, in connection with the Eupyrchroite, contains, as I have satisfied myself by BERZELIUS'S test, phosphoric acid, probably in combination with iron, alumina and lime. This fact is mentioned for the purpose

of directing the attention of mineralogists and geologists to trap dykes, whose composition has hitherto been disregarded; or, it has been sufficient to class them under the general name of trap dykes, or greenstone dykes. It is an easy matter to overlook and mistake the real character of these intruded masses, inasmuch as they may all appear under a dingy green color, and compact or slightly crystalline structure, as the Eupyrchroite and its associated rock at Crown-Point seems to show. Phosphate of lime has received the trivial name of Apatite; in this mineral the elements are combined.

Bones contain about fifty per cent of phosphate of lime, the remainder is gelatine. About twelve per cent of carbonate of lime is also found in bone. Eupyrchroite contains nearly twice the amount of phosphate of lime, according to Dr. Beck.* To supply phosphate of lime to the soil bones have been principally employed. Bones owe their value both to the animal matter (cartilage) and the phosphate of lime: of the two, however, the phosphate is by far the most important. We have seen already that this substance exists only in extremely minute quantities in the soil; and hence, in consequence of this fact, and another, that plants require it in comparatively large quantities, it is exhausted at an early period after the lands are cropped with grasses and grains. Bones which are buried in the earth gradually lose their gelatine, while the mineral matter remains.

The form in which bones are used with the greatest economy is in powder, or dissolved in sulphuric acid. Circumstances will dictate the form which it is best to select. When bones are immersed in sulphuric acid, the phosphate is partially decomposed, or the sulphuric acid displaces a portion of the phosphoric acid, which is set free, or there is formed an acid phosphate of lime, which is far more soluble than the bone earth before this change. In this condition it acts promptly. When bones are buried in their entire state, they still produce good effects upon vegetation; but the effect is slow, and of course long continued. For some purposes, coarsely pounded bones are highly useful: buried, for example, in a trench where it is designed to raise grapes, a supply of the phosphate is obtained for years; the bones, in the mean time, yielding their organic and inorganic portions to the wants and necessities of the vine. By combustion, the whole of the animal matter is consumed, and nothing remains but the earthy parts, which still retain the form of the original bone. If they are acted upon by caustic lime or potash, the animal matter, gelatine, is removed, though not entirely. In regard to the action of bones, Liebig makes the following calculation: one hundred parts of dry bones contain from 32 to 33 per cent of dry gelatine; now supposing this to contain the same quantity of nitrogen as animal glue, viz. 5·28 per cent, then one hundred parts of bones must be considered equivalent to two hundred and fifty parts of human urine. He remarks farther that bones remain unchanged for thousands of years, in dry, or even in moist soils, provided rain water does not have access to them. Bones of the glue makers, or those which have been employed for making glue, when ground and mixed in a heap, become warm, and undergo a species of fermentation.

* Chemistry as exemplifying the Wisdom and Benevolence of God. Appendix, pp. 136–139. See Beck's Mineralogical Report, p. 240, giving phosphate of lime 92·0.

The remaining gelatine is decomposed, and its nitrogen converted into carbonate of ammonia and other ammoniacal salts : these are retained mostly by the earthy part of the bones. As it regards the changes which antediluvian bones have undergone, it is evident that under favorable circumstances, they have retained almost perfectly their composition. Thus the bones of the mastodon, found in marl in Orange county, are perfect where there is a compact stratum of peat upon the top of the formation. Renewed fresh or rain water is denied access to these bones, and hence their perfect preservation ; it is evident, too, that the waters in which they have been so long immersed, have not contained, at any time, carbonic acid, otherwise they would have been corroded. All the bones of quadrupeds which die, and have died upon the surface and have been exposed to the ordinary atmospheric agency, have been destroyed after a few years of exposure only—scarcely a trace of a skeleton of an animal remains upon the surface after eight or ten years exposure.

The quantity of crushed bones required per acre. From five to six bushels of bone dust per acre may be employed to advantage on lands which are to be sown with several crops of grain, or a rotation in which wheat and oats or maize are to be applied. A bushel of bone dust weighs fifty pounds, if they have been boiled for glue : it is worth fifty cents per bushel. The dust may be applied immediately after, or immediately before the sowing of the seed. It becomes immediately active in forwarding the crop, having, in the course of boiling, absorbed considerable water, which replaces the fat and gelatine, which favors the solution of the remaining animal matter. The effect of boiled bones is more immediate than those which have not been boiled, but the duration of their influence is of course proportionally less. One of the most valuable effects of bones is the prolonged effect which follows their use ; this is known to continue for twenty or thirty years. It is customary, however, to repeat their use upon each successive rotation. The crops which require phosphate of lime are the cereals, as wheat and maize particularly ; flax and hemp ; turnip and other roots. But wheat and maize feel the favorable influence of bone dust, and indeed it is scarcely possible to raise a good crop of either, except by the use of the phosphates. This remark is intended to apply to those districts which have been under culture a half century or more, and have borne many exhausting crops of the cereals, tobacco, flax and hemp.

Phosphate of lime acts directly, and in virtue of its constitution, and the relation it bears to the vegetable and animal nature. It does not, like lime, affect the chemical combination of other bodies ; that is, it does not decompose them. In the soil the phosphate is the comminuted apatite, or the tribaric phosphate, which possesses but little solubility ; and hence the probability that apatite, provided it should be found in sufficient abundance, might be employed as a fertilizer. Its sparing solubility may appear objectionable at first, still, if apatite is converted into the superphosphate, by oil of vitriol, its solubility is increased, and its effects, as a fertilizer, are seen as speedily as where bones are employed.

Bones and other phosphates, then are articles of food for the plant ; and the theory of their action is simple. Where bones and the phosphates are converted into the superphosphate, by oil of vitriol, sulphate of lime is formed, and hence we add to our fertilizer sulphuric acid,

which in itself is a valuable addition, and which, if no other substance is employed, will produce favorable effects upon the growing vegetable.

Bone dust is not restricted, in its application, to the cereals; it may be applied advantageously to pasture lands. When it is known that milk is rich in phosphates, and where it is converted into butter and cheese, and sold to customers at a distance, it is evident that the pasture lands are in a state of gradual exhaustion, and hence will require a replacement of the substances which are being lost; hence, as bone dust supplies just what is lost to the land in the milk, it is evident that bone dust is just what is wanted to restore the lands to their wonted fertility. In England, JOHNSTON states that pasture lands have been benefited by sowing from thirty to thirty-five hundred weight per acre; and that the return for this outlay, which costs about £10, has raised the value of those lands from 10*s*. to 40*s*. per acre. The increased value remains after the lapse of twenty years; though a diminution of profit begins to appear, they are still worth from two to three times the rent paid before the bones were laid on.

Considering the prolonged effect of phosphate of lime, it is evident that it is a cheap fertilizer. In the vicinity of New-York, Albany, Rochester, Buffalo, and other towns in New-York and New-England, where milk is largely consumed, it is evident that, without considerable expense, the lands must deteriorate in richness by the milk alone which is consumed. Every forty gallons of milk contain one pound of phosphate. In the average yield of milk for one cow, per annum, there will be carried off phosphates which are equivalent to thirty pounds of bone dust. There is still to be reckoned the consumption of other matters; and JOHNSTON estimates the loss to a dairy farm, per annum, about fifty-six pounds of bone dust in all. A farm continued in dairy for twenty-five years, and which is stocked with forty cows, will remove in that period a large amount of the most essential and expensive material. Pasture lands, therefore, which are fed for many years, will show the losses they have sustained, by the appearance of poorer kinds of grass, moss, loss of vegetation in may places. That bone dust, or the phosphates, applied in some form or other, will restore greenness and fertility, need not be doubted for one moment. A spontaneous indication of this truth is furnished very frequently in small areas called fairy rings, which owe their peculiar verdure to the decomposition of fungi, which have grown and decayed upon these places. Those fungi are rich in phosphates, which they have brought from the subsoil to the surface, or they have deposited the very material which is indicated and required for the pasture, generally. There will be economy in the procedure. This assertion rests on the fact, that in proportion as the feed deteriorates, so will the milk, and hence, milk which is produced by well fed and thriving cows yields a greater profit in butter and cheese..

There is a saving in the application of bone, or the phosphates of lime in their natural state, in the expense which would accrue, if it was attempted to use the bulky and heavy yard manure, where the lands were situated at a distance from the stables. There is another fact of importance, which should not be lost sight of; the addition of the phosphates will always be advantageous, and is not, like other fertilizers, liable to dissipation and loss. They may not exhibit visible effects at, or soon after application; and hence, for this cause, the expenditure

may appear to have been lost; still there is no occasion, really, to anticipate such a result, inasmuch as no vegetable grows without consuming them. It is, perhaps, a matter of time. It is only upon lands which have been half worn or exhausted, that fertilizers show their immediate value and power. On those lands which contain a tolerable supply of lime, the addition of this substance is not seen in the crops; still no one can doubt but that the land will wear longer for this addition, or in other words, so far as the lime is required, its natural stock will last longer for the addition. To a certain extent, marl and crushed shells of a sea beach may be substituted for the more expensive phosphates. Both fresh water marl and marine shells contain phosphates: they undergo a slow change in the atmosphere and become brittle; but still they should be broken, in order to favor a more rapid disintegration. That this change is slow is proved by the fact that oyster shells, in large beds, which were raised above the ocean long ago, remain entire and perfect. This is witnessed in numerous places. It is by the solvent power of carbonic acid that the phosphates are dissolved and brought to a condition suitable for the absorption by the roots of plants.

Nitrate of Lime. Whenever animal and vegetable matters accumulate, they undergo decomposition, and one of the results of the decomposition is the formation of nitric acid. Nitric acid unites at once with lime and forms the deliquescent salt, *nitrate of lime.* When weeds and the refuse of stables, intermixed with lime and earth, are put together in a compost heap, then this salt forms, or is one of the products of the change which those mixed materials undergo. The process is complicated. These substances contain nitrogen, and during the chemical changes, nitrogen is liberated; but in the act of disengaging itself from its old combination, it meets with oxygen, and in this state of incipient freedom, called the *nascent state*, it forms this combination with oxygen. To complete the formation of the salt, a base must be present. It will unite with lime, soda, potash and magnesia, forming with these, their respective nitrates, all of which are very soluble.

Nitrate of lime is regarded as an active fertilizer: it succeeds better with some crops than others. The charge against it is, that it increases the straw at the expense of the grain. We should infer almost *a priori* that it would form a suitable top dressing for meadows, where it is of course the object to increase the herbaceous part, and the seed is of no consequence. We should also be led to conclude that plants fed upon the nitrates would be richer in nitrogen, than where they are left to obtain as they may, and under unfavorable circumstances, their ordinary food. The nitrates will not remain in the form they are taken up, they rather undergo decomposition, and form the usual nitrogenous matters, albumen, casein, fibrin, etc. Nitrate of lime has not been manufactured for agricultural purposes. It is probable that its effects would be similar to the nitrates of potash (salt petre) and nitrate of soda. The direct application of this salt being unknown, in a measure, it will be passed by withouf farther remark.

Silicate of Lime. An insoluble salt, existing as it does, in combination with some rocks and minerals, it will of course be found, to a certain extent, in soils, and probably, although scarcely, in pure water; the roots of plants, aided by carbonic acid, are competent to take

and employ it to form the tissues of plants, and those of the finest texture. Thus I have found silica in the floral organs of plants, particularly the cereals, which must have been in combination with an alkali or alkaline earth. Carbonic acid acting upon silicate of lime, will form a carbonate; the silica which is thus set free is comparatively a soluble substance, and may be taken into the vegetable. There is a strong affinity between silica and lime, and it has already been observed that one of the uses of lime is to decompose the silicates, as those of potash and soda. If lime is intermixed with organic matter, its valuable effects are increased; the decomposition of the organic matter furnishes carbonic acid to the soil, which also becomes a solvent and an article of food for plants. Silicate of lime is not prepared for agricultural purposes, and is never applied to soils by itself: it may be formed, and often is, when impure limestones, those containing fine quartz, are burned in a kiln for lime. Some of these limestones, if carefully burned, would furnish fertilizers more valuable than the pure carbonate of lime; for instance, the limestones which contain iron, sand, magnesia, potash and soda—the hydraulic limes for example. These limestones, when burned, contain a greater number of the elements which plants require, and hence fulfil indications which pure unmixed lime will not. Burning prepares the materials, and renders them more soluble. But calcareous rocks of this description require to be burnt with great care; the materials should not be fused. Whether the foregoing be true or not, the debris, or soil derived from these impure limestones, is rich in all the essential elements of food; and, moreover, is more subject to decomposition. Compare the delthyris shaly limestone with the pure marbles, and we find the former undergoing decay continually.

From the foregoing remarks on the salts of lime, the reader can not fail to recognize their importance to the farmer: not one of them but that is, in some way or other, connected with the growth of plants. Their effects are by no means uniform; they all do not owe their value to the base, or the lime, but each has its respective merits. Carbonate of lime is a fertilizer slow in its operation, and is of little or no account, unless carbonic acid is found in the soil to serve the purpose of a solvent to it. Water, holding in solution carbonic acid, dissolves the carbonate, or a bicarbonate is formed, which is soluble. It then enters the tissues of plants, and performs important functions, both in virtue of the acid and the base.

Phosphate of lime is important from the acid—the phosphoric, with which it is combined. Here the acid is superior to the base. Though it is one of the combinations which form bone, yet phosphorus freed from lime is an important body in the animal frame. We are not wanting, then, in inducements to furnish phosphate of lime to our soils, seeing it plays a part so conspicuous in the economy of animals and vegetables.

Sulphate of lime is also important in its combined capacity, as well as in the elements which form this salt. Sulphur, like phosphorus, combines with organic matter, independent of, and free from lime. The same may be said, in a lesser degree, of nitrate of lime; nitrogen, one of its elements, is regarded as one of the most important bodies in the animal economy.

In the several changes which are indicated, we learn something of the power of vegetables to decompose the compound bodies. Much greater power is possessed by vegetables than ani-

mals: the vegetable performs all the strong work for animals; they take matter in its rudest form—in its strongest combinations, and break the links that hold the elements together; and yet how feeble are actions of vegetables, compared to those of animals; how feeble is their circulation, compared with that of vertebrated animals. Indeed the higher the animal rises in the scale of organization, the more feeble it is in effecting changes upon matter. The lower races may succeed in digesting inorganic matter, in some of its forms, but vegetables feed entirely upon inorganic matter. Vegetables, then, stand between animals and dead matter, and reconcile, as it were, the dead to the higher forms of life, which, were it not for this intermediate agency, life, with all its powers and attributes, would vanish before the inertness of matter, without a struggle. Is the energy of the vegetable unlike, in kind, to that of the animal? It is safer to say that it is of the same kind. The animal life is made weak; animal life is put to a better use than concocting the earths—inducing the elementary changes in inorganic matter. Related as the races are to time, and to purposes, the functions would be too much interrupted to be thus employed: hence they are constituted so as to take up and use what the vegetable has formed; these are scarcely changed. The albumen, casein, legumin, etc., which has been made by vegetables, is taken by the animal, much as it is; it nourishes him by slight modification, and out of the blood, with its corpuscules and plastic powers, forms organs to support movement, and more than all, a throne, upon which reason may sit and guide the active and intelligent agent.

2. *Magnesia and its Salts.*

Carbonate of Magnesia. This substance is well known as a mild anti-acid and aperient medicine; it exists in many combinations in the rocks and minerals. It is associated with serpentine, and is combined in certain limestones, called *Dolomites*. By itself it is never employed as a fertilizer. It is only sparingly soluble in water; and we do not know that, as a carbonate, it is taken into the tissues of plants. It is true, however, that some of the most fertile soils are derived from the dolomites, a mixture or combination of carbonate of lime and carbonate of magnesia. It might, from this fact, be inferred, that those magnesian limestones, when burnt, would form an excellent fertilizer. Experience, however, proves that magnesia, when caustic by burning, is injurious, though no more so than lime, except that it retains causticity longer; does not readily reabsorb carbonic acid. When, however, the magnesia forms only a small proportion of a limestone, as in the hydraulic limestones, its action is not injurious, inasmuch as the quantity is too inconsiderable to affect vegetation chemically, or the soil mechanically, by forming an indurated mortar or cement.

Sulphate of Magnesia. This salt, which is known in commerce under the name of *Epsom Salts*, is a soluble, disagreeable substance. It is a marine salt, and is obtained from sea-water. It remains in a dissolved state after the muriate of soda (common salt) is crystallized out. The water in which it is contained is called *bittern*. It may also be obtained from the magnesian limestones, by employing sulphuric acid. Sulphate of magnesia may be classed among the fertilizers: it increases the amount of many crops. Thus upon a meadow, bearing grass, fifty-

six pounds were applied, at a cost of 5*s*. per acre, the net gain of which was £1 7 6. This salt, however, is allied to the nitrates, in its effects; that is, it promotes the growth of stalk. It is however true, that, like the sulphate of lime, its acid may furnish sulphur to the grain of the cereals. This salt is not so expensive as to forbid its use in agriculture; and being easily transported, may be employed as a fertilizer, upon meadows too distant to admit of carting the bulky and heavy manures. This substance, however, will operate in a manner similar to gypsum; it will apparently stimulate the plant to take up more nourishment, and hence a field will be exhausted sooner by its application.

Phosphate of Magnesia. It is a substance important to all the cereals. It exists in the soil, and, like phosphate of lime, is derived from primary rocks. Not only are the grains composed in part of this salt, but it also forms a constituent part of beets, carrots, parsnips, etc. It exists in the largest quantity in wheat; and horses which are fed constantly on middlings or shorts, are in danger of accumulations of it in the intestines, in the form of balls. Bones contain a small amount of this salt. There is no mineral substance which is composed principally of phosphate of magnesia; and it is probable that it is formed in plants by a combination of its elements. This fact, however, does not diminish the importance of this phosphate in the economy of vegetables. It also exists in manures, especially those derived from animals fed on the grains.

Nitrate of Magnesia. The nitrate of magnesia is an artificial production, and is prepared in the laboratory, by the union of nitric acid with carbonate of magnesia. Few, if any, experiments upon vegetation have been made with this salt. Its action may be supposed favorable, considering the importance of both magnesia and nitrogen to plants: it will probably resemble, in its action the other nitrates. It will usually be formed in the course of the decompositions which take place in the compost heap.

3. *Potash and its Salts.*

Potash is sometimes called the vegetable alkali, from the fact that the great supply is drawn from the vegetable kingdom. It exists, however, in the mineral kingdom, and is a common constituent of many minerals and rocks. Felspar and granite contain potash, in small quantities, and yet in sufficient abundance to dispose them to crumble, and finally to undergo decomposition, and form a peculiar and valuable porcelain clay. All rocks, if they contained a considerable quantity of potash, would also undergo a rapid decomposition in an atmosphere constituted like ours, where rains and frosts occur in their respective seasons: it would be impossible to protect stone buildings, and prevent a premature decay. Potash may be regarded as one of the most expensive elements of plants. In this respect, it ranks next to phosphoric acid. Potash, in addition to its value and importance to growing plants, is extensively used in the arts of life, and is, in fact, an indispensable material to civilized nations. In these numerous uses, it is more important than phosphorus, though, in the progress of nations, every element increases in value. Many articles which are not of prime necessity become highly important from convenience; thus the phosphoric matches are almost indispensable in the

family ; they are not, however, of the same necessity as potash and soda, or lime. We are looking now to the value of different materials for the growth and production of vegetables.

Carbonate of Potash. In no case can the uncombined potash be employed in husbandry, or as a food for plants. Indeed such is its avidity for carbonic acid and water, that it almost baffles the skill of chemists to preserve potash pure, or prevent its combination with these substances. Wood ashes, as is well known, contain the carbonate of potash ; and from them it is obtained by lixiviation. By reference to the analysis of the ashes of different species of wood, it will not escape the attention of the reader that different species contain potash in different proportions ; so also another fact of equal importance will appear, that different parts of the same tree contain this alkali in different proportions.

As a fertilizer, the facts in regard to its value will correspond with the foregoing statements, some plants requiring more and some less. It is, however, a necessary constituent of every soil ; and where it is wanting, a soil is utterly barren—so far as it is capable of producing valuable plants, for the use of man and animals. The impure carbonate of potash, as it exists in ashes, is the form in which it is usually applied to soils. Farmers, however, have been too much in the habit of selling their ashes at a price far less than they are worth for agricultural purposes. In selling ashes, however, it is not disposing of potash alone, but also of the phosphoric acid, in which they more or less abound ; and even where they are not sold, it is not uncommon to leave them in heaps, in their yards, especially their leached ones, which are still highly valuable, from the phosphates of lime, magnesia and silicate of potash, which they still retain.

The value of ashes has been proved by long use. When obtained from the soap boiler, or from an ashery, they are usually spread upon the land with a shovel, and not sown. The quantity has varied with different individuals : from fifty to seventy bushels per acre have been given to the land. In this proportion the crops exhibit its presence for ten or twelve years. Gravelly and sandy soils are especially benefited by this application, for not only are valuable substances added, but the mechanical condition of the soil is improved also. Ashes, in the form and quantity stated above, will increase the compactness of a gravelly or sandy soil, and do something for obviating the looseness of such lands and prevent the rapid loss of the fertilizers.

Another profitable mode of applying ashes is to sprinkle a spoonful or two upon the hills of maize or potatoes, after they have attained a height of two or three inches. The good effect seems to be increased by making this application just before a rain. Leached ashes have a tendency to form a compact bed. When laid upon a cellar bottom they form a perfectly hard, dry surface ; and when spread upon the walks of a garden, it becomes so compact and hard that weeds rarely grow upon the surface. These facts illustrate the effects which would follow from an excessive use of ashes, leached or unleached.

Coal ashes possess an inferior value : it is, no doubt, variable. They contain, besides matters insoluble in acids, lime, magnesia, iron, manganese and traces of potash, and phosphoric acid. Good effects appear to follow from their use upon grass lands, and are partially valuable on stiff clay lands. Very few farmers, however, have thought it profitable to trouble themselves

with coal ashes, and it is true it would not be profitable to haul them a great distance; still, on all the clay lands within three or four miles of a city or village, coal ashes would remunerate farmers for their expenses in transporting them, as this is the principal expense incurred. Their effect is both chemical and mechanical, furnishing lime, magnesia, alkali and some phosphates, and creating a lighter condition.

Sulphate of Potash. Sulphate of potash is made by the union of sulphuric acid and potash: but it is obtained from the decomposition of nitre by sulphuric acid, in the manufacture of nitric acid. It is found, by experiment, to increase the products of the soil. Its price, however, forbids its use, and especially so long as cheaper materials are at hand, and are also equally useful as fertilizers.

Chloride of Potassium. This compound is found in the stems of potatoes; also in corn-stalks and beans. It is not, however, known to exist in the seeds of the cereals. Occurring as it does in the vegetable kingdom, it is probable that it is of some use: its value, however, has not been determined.

Nitrate of Potash, (*Salt Petre.*) This salt is formed under circumstances identical with those described under nitrate of lime. A source of nitrogen is provided in the organic matters. The mineral matters are ashes, consisting of lime, potash, soda, magnesia, etc. An impure nitrate is first formed by the union of its elements. In the vicinity of old buildings, as out-houses and places where cattle are fed and kept, the soil becomes charged with nitre; but being a very soluble salt, it does not accumulate, except where it is protected by buildings, in consequence of filtration of rain water through the soil. In regions where no rains fall the nitre is produced spontaneously, and forms beds of considerable extent: but where such accumulations occur, or even where there is only a slight excess of nitre, the soil becomes barren.

Nitre, in small quantities, promotes the growth of plants, and increases the product somewhat beyond the ordinary amount; it increases always the amount of straw. When used as a top dressing for barley, the crop has amounted, in some experiments, to between thirty-seven and thirty-eight bushels to the acre, laid on at the rate of fourteen pounds to one-eighth of an acre. This is by no means common. The straw in this case was considerably greater than that produced by nitrate of soda, which gave fifty-two bushels to the acre. I notice this experiment by Mr. Heming, as it shows that where circumstances are unfavorable the application of saline manures will be an injury. The top dressing with nitre was succeeded by dry weather, or with but little rain, and the consequence was that the plants were burned, as the expression is. There is, therefore, some risk always in the use of saline fertilizers: they require sufficient rain to effect a very dilute condition, and which will also carry them into the soil. If applied early, or with the first rains of the season, they get an early start, and when the land is covered with herbage, or well shaded, there is little danger of the crop suffering an injury from drought. If the top dressing is delayed till after the early rains have fallen, the risk of an injury from want of rain is considerable. When nitre can be procured at a cheap rate, its application to meadows proves more economical than to the cereals, inasmuch as it seems to be an established fact that the nitrates promote the growth of stalk and herbage.

Silicate of Potash. Glass is a silicate of potash; but the compounds of silica and potash are not well understood. Silica in its ordinary state is nearly insoluble; it becomes soluble by union with potash, the solubility increasing with every addition of the alkali. Silicate of potash exists in rocks, and also in soils in a state of minute division. In distilled water the natural silicates of the soil are also nearly insoluble; but the carbonic acid of rain water and the water of soils are competent to effect a solution, and which fits this compound for the use of the vegetable kingdom. Silicate of potash is required by all indigenous plants, as they contain a great amount in their stems, and by which they acquire strength. The grasses and grains, without silex in their composition, would be unable to rise upward and withstand the winds. This compound exists also in the husk of grains; it is necessary for protection against insects, and to preserve the vitality of the seed. One of the defects of a soil for the production of the cereals is the absence of this salt. The defect will be observed in the weak straw, and its early prostration after rains and winds. Silicate of potash, it is evident, requires to be mixed with other fertilizers in order to secure a profitable investment. A mixture of the following kind has been used with success: sulphate of ammonia seven pounds; silicate of potash, sulphate of soda, bones dissolved in muriatic acid, fourteen pounds each. This amount was applied to one-eighth of an acre of oats. The weight of the crop, when cut, amounted to 1600 pounds. The amount of grain was sixty-five bushels and five pounds. Sulphate of ammonia applied to the same crop, of the same area, gave 1108 pounds; and in grain fifty-two bushels and eighteen pounds. A mixture of the substances detailed, it will be observed, furnishes many of the necessary substances required by the cereals. When it is in the power of the farmer to compose artificial fertilizers, it is necessary to consider, first, what his particular crop requires in the shape of food, and then, if possible, make the mixture to supply its special wants.

4. *Soda and its salts.*

The salts of soda being, generally, cheaper than the salts of potash, have been more frequently employed as fertilizers. Soda, however, is not seen to be so essential to vegetation as potash. The great repository of soda is the ocean. Soda is abundant in the mineral kingdom.

Carbonate of Soda. It is the soda of commerce: it is manufactured from common salt; marine plants is another source. It becomes dry in the air, or loses a portion of water. Carbonate of soda acts upon the soil, and promotes vegetation directly by furnishing the proper food; and in the next place, it operates indirectly by its effect upon the constituents of the soil, dissolving the silicates. We may suppose, therefore, that both carbonate of soda and potash will act favorably upon the wheat crop and other grains, by supplying directly the necessary food, and by giving to the plant also dissolved silica, or the soluble silicate of soda or potash, as one or the other has been employed. We have little reason to doubt but that acids, in combination with their bases, are decomposed, and it becomes one of the sources of carbon. The cereals do not seem fitted to acquire their carbon from the atmosphere; and it does not appear that it is necessary they should, inasmuch as there is such an ample storehouse in the soil.

Johnston remarks that the carbonate of soda is applicable to meadow lands overgrown with

moss, and put on in a weak solution, as a top dressing, may be expected to produce important results; and when there is a certain prospect of rain, applied to the young corn and potatoes, will give the plant the same advantage as when applied in solution. One of the great objects, it appears to me, which may be obtained by the use of fertilizers of this kind, is to give the young plant an early start; to give it, as it were, strength and constitutional vigor. If so, it will better stand the vicissitudes of the season, and go through the dangers of a drought uninjured, and reach thereby an early maturity, by which, also, it escapes the autumnal frosts.

I may, with propriety, make a remark here, that many of those substances which are regarded as too expensive for field culture, may be employed with profit in the garden. In this branch of husbandry, it is necessary to bring the plant forward at an early day as possible; and unless it can be forced forward, the prospect of gain will be considerably reduced. We need more information in regard to modes of culture of market plants. It is true the hot house supplies many of the lighter articles at an early day, yet it is at the expense of a high flavor.

The quantity of carbonate of soda which it will be profitable to employ, can not be determined with certainty. It is to be remembered that it is a very soluble substance, and a sandy soil would probably lose, by filtration, a portion of the quantity laid on before the plants have taken root. It seems better to employ small doses, and repeat them. A solution of fifteen or twenty pounds to the acre, and repeated during the growth of the crop, will be the most economical way of employing it. This salt few would think of applying during autumn, though its action upon the silicates should not be disregarded; still, the autumn and early spring rains would probably remove much of the substance from the soil. Apply it, then, to the young crop when it has risen a few inches above the ground, to give it a new start; and then, subsequently, when it is about one half grown. This salt will be consumed by the crop, and the advantages will be reaped at harvest.

The theoretical action of soda upon plants has been already suggested. Both soda and potash are nutriments in the vegetable kingdom, being more required by some plants than others. They also render soluble the natural silicates already in the soil: they combine with the organic matter, and it is by their action that it enters the plants, through their roots, and contributes to the amount of carbon required by their tissues. Again, in the economy of animals, the alkalies, especially soda, in its free state, is employed to preserve some substances in solution. The albumen in the egg is prevented from a coagulation by free soda; and in the plant, the moving sap or fluids must be maintained in a liquid condition, wherever the albuminous matters abound: this is effected by the alkalies, in many instances. The albuminous matter of vegetables, however, is preserved more frequently, in a soluble form, by a large amount of water.

Nitrate of Soda. This salt exists in the dry parts of Chili and Peru, in extensive deposits, as a natural production. It is sufficiently abundant to constitute an article of commerce. Being cheaper than nitrate of potash, it has been employed more extensively as a fertilizer, in England, than the potash salt. It is quite soluble, rather deliquescent; and for this reason it is probable, that when employed in a dry time, its injurious effects, which are described as a burning of the plant, are less than salt petre. The results, however, of this salt are not uni-

form. It agrees in one particular with nitre, in its action upon grain crops, viz. by increasing the height and quantity of straw and foliage, without increasing, in a direct proportion, the amount of grain. This fact seems to have a meaning: it at least shows that increase in the breadth and size of the leaf does not give a greater amount of nourishment to the seed. It has been asserted that if we give food to our vegetables, and thereby increase the foliage, they will take a greater amount of carbon from the atmosphere, and give in a better crop. The effect of the nitrates does not seem to sustain this view. More carbon is made, it is true, but the greater expansion of leaf does not give more weight to the seed, or prepare nutriment for distant parts. It proves that each organ works for itself; that the cell, in its own sphere, is the elaborator of food, and modifies the sap it receives, in its own peculiar way; the leaf cells in their way; the root cells and stem cells in their way; and finally, the embryo, or seed cells, in their way. From the general stock of nutriment each part derives a supply of food, but modifies it by its peculiar and inherent powers.

The farmer will be able to make for himself practical rules for the application of nitrate of soda, and even the nitrates generally, from the foregoing facts: he will not apply nitrate of soda to a grain crop, unless he finds it necessary to give greater vigor to the straw and herbage. Now there are cases in point, which I have witnessed, where a weak straw was the great defect of the soil: the crop was invariably laid, but the grain was good, except from the injury it sustained by prostration. Especially is this the case where rains fall, accompanied by some wind; the grain is prostrated, and the straw is too weak to rise. In cases of this kind the application of nitrate of soda will do much towards saving the crop from injury: it is the proper medicine to prescribe; it will not be expected to add much to the grain in its own capacity. Again, a crop, as has been stated elsewhere, which consists of stalks and foliage, is the proper one on which to employ the nitrates. There is another effect of this and its congener salt; they improve the quality of the foliage, and make it more agreeable to cattle. The effects of the nitrates, then, are to impart greenness and freshness to the foliage; to hasten and prolong its growth and increase its weight, by promoting the growth of fibre; and impart a savoriness unknown to the unmedicated growth. Potatoes and peas will not be greatly benefited by these salts. The tubers do not appear to increase with the foliage. This fact, that foliage is no indication of a great yield of tubers, is well known, and the language used is that "the potatoes have all grown to tops." Clover and grasses seem to be crops, if the foregoing is true, which may be profitably cultivated with the nitrates. We secure, thereby, more weight in the season of grass, and prolong the effect into autumn, which is very desirable in dairy farming. It is at this period that butter may be laid down, for winter and spring use, to the greatest advantage and profit. It is not determined whether its quality is better when made from nitrated grass, or not; it is probable that it is so. The quantity of soda which may be employed, per acre, will vary from 75 pounds to 150 pounds. A mixture of this salt with sulphate of soda is more suitable to all crops than its employment without mixture.

Sulphate of Soda, (*Glauber Salts.*) In the manufacture of muriatic acid from common salt, sulphate of soda is formed. Its action upon vegetation is similar to that of sulphate of

potash: it is, however, cheaper, and sufficiently so to warrant its use in husbandry. It is not an universal fertilizer, and some experiments indicate that favorable circumstances are essential to an increase of product. A mixture of this salt with nitrate of soda, forms a better application than either, singly: on oats it is known to be less effective than the superphosphate of lime, or bones dissolved in sulphuric acid. The latter increases the weight also, per bushel. Those plants which require sulphur, or sulphuric acid, are benefited by this salt.

Chloride of Sodium, (*Common Salt.*) The general impression, in regard to salt, is favorable, as to its fertilizing properties. The vegetation of some plants shows, conclusively, the speciality of certain substances as their common food. Marine plants, for example, have their habitation fixed, as it were, along shore: they require a great amount of saline food, and hence will not survive when transplanted to the interior, or at a distance from salt water. Where saline springs exist in the interior, far removed from salt water, there they make their appearance as on the sea coast. Common salt, then, has its adaptation to marine plants, but has not been very efficacious in promoting the growth of the cereals, and other plants which have become an important article of food. Wheat contains only a trace of chlorine, and although soda is a constituent of the ash, it is not, by any means, necessary that it should be derived from salt. Clover contains chloride of sodium. Madder root contains the largest proportion of any vegetable which is cultivated, amounting to over eleven per cent. The leaves and stalks of broom corn and of maize, hay, of the coarse grasses particularly, all contain common salt. The effect of common salt seems to be limited to the stalks and herbage, in which respect its action resembles the nitrates; perhaps the same indications for the use of this substance may be employed. Fields which produce a weak straw may be sown with salt, or a top dressing for the crop.

Much has been said upon the efficacy of salt as a remedy for injurious insects, the wire worm, grubs, etc. Its effects, however, have been overrated; it is true that it destroys these vermin, in its concentrated state, but used in a proper dose for plants, its influence is but feeble. The plum tree is benefited by the use of salt freely upon the soil beneath it. Fertilizers are valuable remedies for worms: high cultivation, indeed, is the most successful mode of treating wormy lands.

Silicate of Soda. The constitutions of the cereals require, as already stated, silica. Soda, in combination with silica in any proportion, is one step taken towards supplying those plants with silica: soda, then, performs the same office as potash. In the present state of our knowledge it is difficult to know which should have the preference, unless indeed cheapness is taken into consideration. Soda is less expensive, and, therefore, may be employed in preference to potash. The artificial silicates of the alkalies have not been introduced into use, even in England, notwithstanding their recommendation by men of high authority; and yet, when the seasons favor their solution, there can be no doubt of their value. May an inquiry be entertained in regard to the least expense of supplying silica; and if guided by the true principles of economy, would it not result in proving that it is cheaper to prepare silica in the soil, by the application of lime, than by the artificial compounds prepared by the fusion of the materials? Silica

abounds in the soil, it need not be added, though in its ordinary state, it is quite insoluble; but, by the use of lime, may we not always obtain it in sufficient quantity for use of vegetation, without a special addition to the soil? and I think experience proves the economy of the use of lime, and has a preference to LIEBIG's patent silicate of potash and soda, which has created some noise, and has been recommended on the authority of his name.

5. *Of Mixed Saline Substances.*

I have spoken of the simple salts, as they have been used separately and alone. As plants require several elementary bases, in combination with acids, it seems more agreeable to the nature of the case to add mixtures of the salts of soda, potash and lime, as then the general wants of vegetation will be far more likely to be met and supplied. Thus, if the sulphates of lime, soda, magnesia and common salt, or the nitrates of potash and soda, with common salt and gypsum, were mixed and used, the result would be better than the use of either singly. There are various modes or proportions which may be observed in combining them, which will meet the wants of the crops: these proportions may be determined by consulting the analyses of the plants, which are given in books upon this subject. Indeed there is no other source from whence our rules for the formation and application of fertilizers can be derived. These mixtures may be used as top dressings, or they may be incorporated with the compost or manure heap. But in general these very soluble fertilizers, as the nitrates and sulphates of the alkalies, are better adapted to growing crops, and to be used as top dressings. Top dressings may be applied in two states, either in solution in water, or in powder, and sown broad cast. For the former, the solution should be extremely dilute, scarcely or only slightly saline: in the latter state the powders require intermixture with gypsum or ashes, in order to secure an even distribution over the field, and also to prevent a concentrated effect upon the different parts of it. When concentrated they have an effect which is described by the term burning—a term expressive of the apparent action of too high a temperature. Instead of ashes, which has been often recommended for mixing with saline matters, bone dust, when it is possible to procure it, will be equally good or better than ashes, or if the ground mineral phosphate can be procured, it will be quite as good as either. It is now ascertained that the latter may come into use to a limited extent, as it is now proved to exist in veins in primary rocks. The mineral called eupyrchroite, which I discovered at Crown Point, forms a vein varying in width from two to six feet, and hence may furnish a large amount of native phosphate of lime, in the same condition as it exists in the soil. This substance is less soluble than bone dust, and hence its immediate effects may not be so striking as to arrest the attention of the farmer at once, yet it will last longer and be more durable. Immediate effects are often desirable, and even necessary, but when farmers have employed a fertilizer which is common in the constitution of all plants, they need not regard the substance as wasted or lost, even though the first effects upon his crops are not very striking. Thus common carbonate of lime, when sown upon his fields, may not produce an increase in the value of his first crop, yet lime is one of the essential constituents of all plants, and must exist in the soil: so especially the phosphate of lime is still

more necessary to fertility, and there is no substitute for phosphoric acid. Plants may obtain lime from the carbonate, sulphate or phosphate : it is, I believe, only from this single mineral, the phosphate of lime, that phosphoric acid is obtained ; and as its quantity in the soil is always exceedingly minute, its artificial supply can never be lost to the soil—in the end it will tell, and the fertility of the land will continne the longer, in consequence of any supply of it which a farmer may see fit to give. I have always spoken of this substance as one of the expensive fertilizers : if, then, the immediate effects of a manure of a known composition does not tell upon the crop at its first application, it does not follow that its application will be lost, especially when the substance is essential to the constitution of all plants.

6. *Wood and Coal Ashes.*

Wood ashes being derived directly from plants, they must always form an important application to all crops ; they are, in a measure, similar to the foregoing mixed saline fertilizer, already recommended, only they are more complex in their constitution, and hence, better fitted to meet the general wants of vegetation. The general constitution of the ash, of most cultivated plants, may be ascertained by consulting the second volume of the Agriculture of New-York. Three important substances are always present, though variable in quantity in different plants, and different parts of the same plant : thus potash, soda and phosphoric acid are always present. Lime enters largely into the constitution of the bark, and sometimes the wood : oak, beech and hickory contain lime in very large proportions, as 70 per cent and more. One of the best modes of applying ashes is directly to the young growing plant. Maize is remarkably benefited by the application of a single handful of ashes, when two or three inches high ; and sown upon wheat or the cereals, or upon meadows, its effects are immediate and quite durable. Leached ashes, though less valuable, exert immediate good effects upon the same crops. There is some danger of applying leached ashes too abundantly ; in that case, the surface of the ground becomes compacted and hard : indeed leached ashes form walks in gardens almost impervious to weeds, and hence we may well suppose that this form of ashes is well adapted to loose sandy soils, and that they will correct, in a measure, this quality. Still there is a limit to their use, even upon this kind of soil, for it is agreeable to the principles of good husbandry that all excesses in the application of any one susbtance should be avoided ; and the advantages of large quantities of fertilizers, added at one time, are far less than when given the soil in divided doses, at wide intervals of time.

Anthracite and bituminous coal ashes must be regarded as weak fertilizers : they contain lime, magnesia, a trace of phosphoric acid and alkalies. Upon grass lands experience proves that they possess considerable value, especially if the soil is argillaceous ; but they can not be useless upon sandy soils, though, mechanically, they will be inert. About one-third of their matters are moderately active in promoting vegetation. Ashes from the mineral coals should, by no means, be wasted, although they will not pay for transportation, except for short distances around our cities and large towns.

Peat ashes and soot possess valuable properties : they contain more potash and phosphates

than anthracite coal ashes; indeed, abating the quantity of earth which is necessarily intermixed with peat ashes, I can see no reason why they should not be nearly equal in value to wood ashes, inasmuch as they are derived from vegetable matter. In some parts of New-York, particularly in that tract of country extending from Rome to Syracuse, peat ashes might be manufactured expressly for fertilization. Heaps of peat might be made, and, after drying, burned upon the field, and their ashes spread. The whole operation would be attended with little expense. Ash obtained in this mode will be intermixed with much charcoal, or peat imperfectly consumed, which, in itself, will become valuable in promoting a rank vegetation. Allied both to charcoal and ashes, is soot: it is esteemed as a valuable fertilizer abroad. Imperfectly burned wood or coal rises in vapor and smoke, from the burning substance, which is deposited in the flues and chimneys. Soot is quite as complex in its composition as ashes; indeed it is probably more variable, and we find one element which is not present in ash, namely, ammonia. Phosphates and sulphates, together with carbonates, of lime, soda, potash, iron and magnesia, are the principal constituents. Soot will be applied in a diluted state, as a top dressing, and may be used to the extent of thirty or forty bushels to the acre: very few instances, however, are known of its use, in this country, on so large a scale.

7. *Crushed and Ground Rocks.*

To what extent crushed granite, or slates and shales, may be used with profit, as fertilizers, has not as yet been determined. That a soil is benefited by the application of ground rocks, there can be no doubt. In England crushed granites are employed for the sake of potash, and probably the phosphates are also contained in them. I have ascertained that some of the shales and slates of our sedimentary rocks contain fertilizers, which, under favorable circumstances, might be employed. The profits of such application turn much upon the accessibility of the substances. All that I can say upon this subject, is, that where a farmer finds crumbling rocks upon his premises, it indicates the presence of alkalies, or the sulphurets: if the latter are present astringent salts are usually produced. Long exposure to the weather, however, prepares even these salts for his fields; or, the application of lime will form, with them, almost immediately, a valuable fertilizer. All the changes which the weather produces upon rocks should be noticed, as from those changes the farmer will derive many valuable hints. I suspect that if the layers of the different groups of rocks were carefully analyzed, that some of them would be found to contain valuable fertilizers, in constant, though small proportions. Rocks which are suspected to contain potash, might, when crushed, be mixed with quicklime, in order to hasten the process of decomposition. Those granites which offer the best prospect of yielding the alkalies are coarse grained, and contain felspar in excess. The localities at which these granites occur in the State of New-York are limited: Johnsburgh and Minerva lie in a limited belt, where decomposing granites are common. The primary of the northern interior consists of hypersthene rock, which contains lime, mostly as a substitute for potash. In the southern highlands, the rock is mostly gneiss of a firm texture, and only slightly inclined to disintegration. The greenstone trap offers the best prospect of furnishing potash.

II. Fertilizers of the vegetable kingdom.

There are two classes of fertilizers, one derived from the vegetable, the other from the animal kingdom. The organic fertilizers, however, are often of a mixed kind : barnyard manures, for example, consist mainly of vegetable matter, the straw and hay, intermixed with a small quantity of animal matter. The excrementitious matters of some animals may, indeed, be regarded as purely of animal origin, as guano, inasmuch as the birds fed entirely upon fish. Some fertilizers, again, are purely of vegetable origin, as sea plants, peat, and all decomposing vegetables.

8. *Green Crops, etc.*

As a general thing, vegetable matters are not active fertilizers, and yet they are efficient, and may be relied upon. Those which may first be considered are green crops, consisting of the immature or unripe vegetables, as buckwheat and clover in blossom. When in this state, and ploughed under, the plant decomposes, or decays gradually, and furnishes a supply of nutriment for a lengthened period. Many advantages arise from the use of green crops : the matters of the soil are brought up from a depth to which the roots penetrate—and they are of that kind, and in the proportion which vegetables require ; they are intermixed with the soil more evenly, and hence become more accessible to the growing plant ; there is, too, less expense attending the care of green crops, especially where the field is distant from the homestead. There is no addition to the soil of the expensive fertilizers, as the phosphates and alkalies ; these are only brought within the reach of the succeeding crop. When clover is the crop selected, it is maintained that it takes from the atmosphere important elements, which become a clear gain to the soil and succeeding crop. Turf, when turned over, furnishes, in part, the same elements as clover and buckwheat. One of the results of ploughing in green crops is to improve the mechanical condition of the soil.

Questions have arisen as to the time when these crops should be ploughed in, and a difference of opinion exists upon the subject : probably these differences are not very important, and as to time much will depend upon circumstances ; convenience has to be consulted. Many light soils have been reclaimed by the aid of clover, and no doubt soils so light as to have been abandoned and thrown out to commons, may, by clover and plaster, be brought back to a fertile condition, with less expense of time and money than by any other means.

Another question, in regard to clover, has been agitated, namely, whether it should be fed off by cattle or mowed before it is turned under. It seems to me that it turns entirely on greatness of the crop ; if it is very heavy it should first be mown : the roots in such a case are large, and will supply all the necessary nutriment to the succeeding crop. Where the whole plant is turned under, if the herbage is large, its course of decomposition is irregular, and it becomes infested with mould, which is never congenial to wheat. It is to be remembered that the use of green crops for manures does not do away with the necessity of supplying, at the proper time, inorganic matters, in some form or other. There is a great liability to commit an error here, especially in New-York, where wheat lands have great power of endurance. The error, it is true, may not become very serious, unless persevered in : it may be theoretical ; reflection will lead to the correction of the error.

Direct applications of growing vegetables—straw, tops of potatoes, and a variety of stalks of vegetables, may be spread over the fields and ploughed in, like a green crop. Upon the sea coast, sea weeds have been largely employed for fertilization : they possess considerable power for the season, but their effects are transient ; they require an annual renewing ; still they are cheap, and should not be neglected, when they are accessible. They are to be employed in the compost heap. The analyses by JOHNSTON give large percentages of potash and soda : sulphuric acid is also abundant ; the phosphates are less, in proportion to the other elements ; they contain much the same elements as the ash of land plants. Sea weed, in consequence of the large quantity of water which is always in combination with it, decays rapidly. Somewhat similar to the sea weed, in its effects, is the common brake, or polypod : there are many species, but they are alike, in their effects upon a grain crop, when ploughed in ; these decompose also rapidly. They may be cut in August, during the rainy weather, carted green into the barn-yard and formed into a compost heap : they may also be spread over a field, to be ploughed and treated in the same way as green crops are treated. All weeds, leaves, saw dust and refuse vegetable matters may be made into a heap, treated with subcaustic lime. They soon become suitable to be employed as fertilizers.

In all vegetables, both organic and inorganic matter is secured to the crop. The addition of organic matter is often necessary to give effect to the inorganic. It is important in the decomposition of the oxides of iron, and hence, too, is quite necessary to the formation of nitrogen in the soil. The most favorable of organic bodies in the soil to produce all the results required, both mechanical and chemical, are the roots : these have penetrated deep, as well as widely—occupy almost, if not quite, the whole ground, and hence, too, affect the soil with great uniformity. Carbonic acid is also set free in the course of the chemical changes which organic matters undergo in the soil. Two purposes, at least, are secured, by its liberation ; it is absorbed by water, and enters the tissues of the vegetable ; it also becomes a solvent for the phosphates and the carbonates, and brings them into a state suitable to meet the wants of the plant. Peat, in its green or fresh state, may be ploughed under the soil, when being subjected to a new class of agencies, it is decomposed, like other vegetable matter, and with like results.

III. FERTILIZERS FROM THE ANIMAL KINGDOM.

The substances which belong properly to this class of fertilizers are the solids and fluids of animals, and their excrementitious matters. They differ, in one respect, from vegetable substances—they are far more active in their effects ; and what is farther true of them, in part, is, they are more transient in their operation. This is particularly the case with flesh and blood, and all those parts which contain an excess of nitrogenous matter. Bone, hair and horn being composed of less perishable constituents, remain a long time, and yield slowly their aliments to plants ; and in this we find a very valuable property. Their decomposition goes on with sufficient rapidity to supply the wants of the various crops to which they are applied, and hence are little subject to waste and loss, when subjected to the ordinary atmospheric agencies. They require to be more or less comminuted, or broken, in order to increase the extent of sur-

face upon which the atmospheric and other agents may act. To this I should add that in proportion to the state of comminution, so will the rapidity of their action be; and it follows, again, that where action is energetic, it must also consume in a comparatively less time the matters upon which those agents are at work. There is a want of information upon the question, what degree of fineness is the most economical? It is evident that there is a certain degree of comminution which will yield the farmer the highest profit.

9. *Bones.*

The composition of bones has been given in the second volume of the Agriculture of New-York. Compare the composition of bones with many of the products of vegetation; we shall then be led to appreciate the value of all those substances which contain phosphates, as fertilizers. We may imagine the phosphoric acid of the soil first transferred to the constitution of vegetables, and then removed upward again to the bodies of animals. All the important fluids and solids of animals are pervaded with the salts of phosphorus.

Bones and the phosphates owe a portion of their value to their bulk; the valuable matters are concentrated in them so that they constitute a portable fertilizer—may be transported, without loss, a great distance, and yield a large profit by their application. In this and the New-England States, which have now lost much of their primeval fertility, portable manures must become of great importance. Experience will finally prove, if it has not already proved, that good cultivation is the most profitable husbandry; and, of course, good cultivation demands an application of fertilizers, since fields which have yielded their increase for one and two centuries, must be measurably exhausted of their original stock of the more expensive vegetable aliments.

On consulting the composition of bones, it will be observed that they consist, in the first place, of two distinct parts—an organic and inorganic part: the first is known under the name of gelatine, the latter that of the salts of lime, soda and magnesia, in combination with phosphoric acid. Since bones have come into use as fertilizers, the question has been agitated, whether the organic part contributes to the effect attributed to bones? Great names are found on both sides. Sprengel and Liebig maintained that the fertilizing effects of bones came from the inorganic part; and that if bones were burned, by which all their organic matters were dissipated, they would be equally valuable. Johnston, of Durham, on the contrary, has collected facts which go to disprove this view, and to substantiate the claim of organic matter as an efficient fertilizer. It is admitted, and indeed, proved, that the inorganic part is a fertilizer *per se;* and I am led to entertain the opinion that it is the most valuable and most important part of bones. The gelatine of bone contains,

Carbon,	50·37	
Hydrogen,	6·33	
Nitrogen,	17·95	
Oxygen,	25·35	Johnston.

This composition is quite similar to hair, horns, hoofs, etc., and hence our experience would justify the conclusion that, like them, it must act beneficially as a fertilizer, *per se*, also. Farmers then will not, under an erroneous idea, consume the gelatine of the solid animal matters. All the advantage which can be claimed now, for the combustion of those parts, is the more pulverulent condition of the earthy parts which remain. It is unnecessary to speak of the modus operandi of bones, since, from what has already been said, it is plain that all their elements must enter into the composition of vegetables, and especially into their seeds. The young growing animal obtains the solid parts of which its bone consists from the milk of the mother, in the first instance, and afterwards from the grass and herbage upon which it feeds.

Methods which have been adopted for securing the efficacious action of bones. Bones, in the first place, should be reduced to powder. The object is to bring the bone into direct contact with the roots of the vegetable, and also to facilitate the action of atmospheric agents upon it. It is well known that bone may be buried in the earth for centuries, without impairing to a a great extent their integrity, and even, under certain circumstances, are preserved, without loss of their animal matter, for more than two thousand years. They should, therefore, be ground either to a coarse or fine powder, if we, in our day, would reap the reward of their application. In addition to the simple pulverization of bones, other additional means are sometimes instituted for hastening their action. Bones, then, after being pulverized, are made into heaps, and covered with earth, for a week or two prior to their intended application. In this state the heap becomes hot by the fermentation which ensues, and the changes which are thereby induced prepare the nutriment more speedily for the young plant. The powder, softened by fermentation, is strewed by side of the plant: it is, in fact, to be used as a top dressing, and is well adapted to use in drill husbandry. Sometimes the powder is fermented with the excrementitious matter of cattle, and it seems to be established, by experiment, that when fermented, its effects are increased, and its value enhanced, or at least it is better than dry bone dust. The object which it is designed to effect by these and other chemical agencies, is, to diminish the cohesion of its particles, and increase its solubility. In order to bring bone dust into the most active and energetic state of which it is susceptible, by the foregoing means, it should, according to JOHNSTON, be exposed for two or three months to fermentation, when the gelatine and earthy matters will become completely softened, and more perfectly resemble the condition of guano.

Another mode which has been adopted, and which seems to effect the objects desired more perfectly than any other, is by solution in sulphuric acid. The apparatus required for dissolving bones, is a large iron kettle, or a large wooden tub, into which the crushed bones are introduced. Upon the bones one half their weight of water may be poured, and, after stirring the mixture, as much by weight of a strong acid may be added, and still stirred, until the materials are incorporated. The proportions are varied by different English farmers; but it is necessary that water should be first applied in order to prevent the charring effect of strong acid upon animal matters, which, if it take place, arrests in a measure the farther solvent action of the acid. It can not be supposed that if an excess of acid is added that it will be lost, in-

asmuch as sulphuric acid itself is a fertilizer. More or less than one half of acid to bone may be used, according to the views of the experimenter; if less, the action of the undissolved bone will be prolonged. The mixture may stand for many days. The plan to be pursued will now be varied according to the intention of the farmer: if it is designed to be drilled in, it will require the addition of fine peat, or light friable soil, when it may be laid up and turned several times in the course of seven or eight weeks. During this time the bones heat and dry up, so as to be ready for the drill. If, on the contrary, it is designed to use the mixture in a liquid state, from fifty to one hundred times more water must be added, in the place of the porous earth or peat, when, after complete solution, it may be distributed over the field, in a water cart. Still more water should be used, provided the application is to be upon young and slender grass of meadows, or young wheat and other cereals. The objection to the last mode is its trouble, for, after all, there are many farmers who are deterred more from improvements of this kind, for the trouble it gives them; there is nothing so desirable with them as the old way of doing things, for which they are prepared. The solution is the most perfect way of applying bone manure. When the effects of this mode of application are compared with guano, it is found that two and a half bushels are equal in effect to two hundred weight of Peruvian guano. See JOHNSTON's Contributions to Scientific Agriculture, page 43. Prof. JOHNSTON also gives a comparative result of the use of superphosphate of lime upon turnips, page 46.

No dressing gave	29¼	bushels	per imperial acre.
3½ cwt. of Peruvian guano, ...	40¾	"	"
4 cwt. rape dust,.....	38⅜	"	"
6¼ cwt. of superphosphate, ...	53⅝	"	"

I believe it unnecessary to proceed farther with a statement of the value of bone in agriculture, as the subject has already been treated of: it is one of considerable importance now, and will become still more so, in the progress of agriculture in this country. Correct views are beginning to be entertained, in regard to a productive husbandry. It is already found, in some quarters, that high culture gives the most profitable returns for capital invested in agriculture.

One suggestion may be thrown out here; do not the pasture lands, which have been devoted to sheep and dairy farming, require more attention than they have hitherto received? If the amount of butter and cheese, or of wool, is estimated fairly, it will be found that much nitrogenous, as well as inorganic matter, has been removed from pasture lands, in the course of twenty or twenty-five years. Pastures which were capable of keeping 5 or 600 sheep, have, in some instances, so far deteriorated in New-England, that only about one half as many can now be kept. This result must undoubtedly be owing to the phosphates which have been removed in the grass. In order, therefore, to bring them back to their original fertility, bone dust, or the mineral phosphates, are required: no other substance can supply its place. Farmers, however, in this country, scarcely think of renovating their pasture lands by the di-

rect application of fertilizers. The time, however, has come when more attention is required to lands in pasture.

10. *Guano.*

The excrementitious matter of birds, in consequence of their peculiar structure, furnishes a mixture of substances rich in all those which are active in promoting vegetation: it is the richest of fertilizers, under favorable circumstances. The history of guano is interesting, particularly so if taken in connection with the places of deposit. To us, who inhabit a country upon which rains never fail, in their season, it is a matter of surprise, when we learn, for the first time, that there are countries where it never rains. It is in those countries that the guano is found. The birds, which are large and numerous, and which subsist upon fish, have inhabited the islands, upon or near the main coast, from the remotest time; consequently, during the centuries which have elapsed, there are accumulations of guano to a vast extent. It is the most highly animalized substance, being, in reality, derived entirely from animal substances; accumulating slowly in thin layers, time is furnished for its partial drying, otherwise, if it was produced in large heaps, it would heat by fermentation, and prove nearly worthless. Guano is composed of the following elements:

Organic matter,	56·00	
Phosphates of lime and magnesia,	26·00	
Carbonate of lime,	6·00	
Salts of soda,	10·00	
Salts of potash,	trace.	
Silicious matter,	2·00	Johnston.

The ammonia is variable; in the Ichaboe guano it does not exceed 6 or 8 per cent. From the nature of animal matters, it follows that ammonia, which is essentially volatile, must be lost in all the changes which this substance undergoes, spontaneously; and hence the varieties, as those from different localities will vary in the amount of ammonia which they contain, and even will vary in samples from the same place. For this reason, too, the composition which has just been stated does not fully represent the condition of guano, as it reaches our shores: oxalate, carbonate, phosphate and sulphate of ammonia should be added. The carbonate of ammonia is volatile, but the sulphate is fixed. These are important substances, and being soluble, act at once upon vegetation. To determine the presence of ammonia in guano, add quicklime to a sample, when, if present, it will be exhaled in the peculiar pungent fumes, known to all persons. The most economical quantity, for an acre of land, varies from three to five hundred pounds. It is one of the peculiarities of this substance that, if applied in large doses, it injures rather than benefits the crop; and, indeed, it is so active that seeds should not be enveloped in it at all, as it destroys, or is very liable to destroy their vitality. Many failures have occurred in the use of guano; they have arisen from too free an application, and also from drought. A dry season is unfavorable to the employment of it; as, in that case, it is not dissolved, and

probably a very wet season will diminish the profit of its application. It is, therefore, somewhat uncertain in its effects, being dependant upon the season, and the first season is lost; much, if not all the ammoniated salts will escape by volatilization, or solution and drainage. It is considered that the effects of guano scarcely extend to the third year. In consequence of its solubility and volatility, its application in divided doses will be the most economical: far south, particularly, an application in the autumn, to winter grain, at the rate of about one hundred pounds per acre; the spring will be a proper time to top dress the crop with another hundred weight of the guano. This mode of application, though attended with more labor, will save the substance and promote the best results which can be obtained by its use.

It is impossible to know what course American farmers should pursue in regard to the purchase of guano; there are contingencies which must be taken into the account, which can not be controlled. When the choice is presented between the phosphate of lime and this substance there is little occasion to hesitate; the preference may be given to the former because the contingencies are far less, and inasmuch as this will remain in the soil a longer period, and the ultimate results will equal at least those of guano.

11. *Of Fish as Fertilizers.*

On the seaboard, poor kinds of fish are caught for the express purpose of employing them directly for manure. The peculiarity of fish consists in the rapidity of their decomposition; this rapid change is due to the nitrogen of their bodies, and the watery condition of their flesh. To make the most of them, it is necessary to cover them in compost heaps, with absorbent porous matters, which shall become imbued and at the same time fixed in the particles employed to prevent the escape of the volatile matters; farmers, however, have been unwilling to be at much trouble and expense, and hence they are usually covered with the earth upon which their remains are scattered. At present this kind of manure is confined to the seaboard and the vicinity of the great inland bays. The conversion of fish into a species of poudrette would render them portable, the interior of the country would, in that case, be benefited by the traffic. There can be no doubt but that a profitable business might spring up by the preparation of fish to be employed as manures. Plaster and lime might be employed to arrest the peculiar putrefaction of masses of fish. We can not suppose that lime applied to a fish, prior to incipient putrefaction, would cause the escape of ammonia; if so the plaster or gypsum would arrest it by absorption. The subject, however, requires experimental investigation: a cheap method is the only one which can succeed. The application of fish over extensive fields, as usually performed, taints the air to a great distance; it is not, however, a miasma which occasions sickness. A compost is made in Rhode-Island, which is called the *fish pie*. Fish are thrown into a shallow pit, or a heap, and then covered with rock weed and loam or sand—peat would be better: fermentation soon begins, or rather putrefaction; the mass is stirred over and duly mixed, and, if necessary, more porous earth added. This preparation is superior to the uncooked fish; indeed there is no difference of opinion in regard to its value, while many discrepant accounts are given of the efficacy of fish, covered and mixed directly with the soil upon

which the crop is to be grown. Shell fish, as clams, scollops and muscles, though not equal to alewives and herring for manures, are still very valuable.

12. *Fertilizers from the Farm-Yard.*

These are not so purely animal as the preceding; they consist of animal matters, intermixed more or less with fine fodder, changed in various degrees by the organs of digestion. The value of all these products is variable; it depends entirely upon the food: rich food gives an active fertilizer. The excrements of geese fed upon grass is less valuable than if they are fed upon corn. Cattle receiving a quantity of corn meal or oil cake, will furnish a manure far more active than when fed on hay. Those fertilizers are all bulky and heavy, and their use is commonly confined to the premises upon which they are produced; their bulk, however, serves an important end, it operates mechanically, and promotes a loose, friable condition of the soil and the pentration of air.

The application of farm-yard manures is well understood: they have been, and always will be, the great sources from whence the farmer will derive his fertilizers; they have few contingencies in their application. If the season is dry their presence in the soil becomes a source of moisture, and a well manured field is more independent of rain than when manured with richer kinds, as guano. The proper preservation of manures of this description is well understood, though it is not always acted upon. The crops to which they may be directly applied are well determined, and the most profitable quantity, though there are fewer restrictions than in the case of the active and energetic manures. There is one point necessary to be attended to; the manure heap should be under cover, and it should never stand through the summer to ferment and burn out. Much of these matters, in cities, where they accumulate in close boxes, are injured, especially the excrements of horses. Another practice should be avoided here; quicklime should not be put into the heaps, but gypsum; with the former ammonia will be lost. The improved system of building barns and out-houses, together with the enclosures, is doing much to save the valuable parts of fertilizers. The more common and free use of gypsum in stables, yards and all places where volatile substances are escaping, seems very desirable, and even necessary, in order to save the nitrogenous matters, so essential to the perfection of seeds and grain. Plaster is preferable to sulphuric acid, which is often recommended, being less expensive and less liable to create accidents by spilling.

The ash of the excrements of the horse has the following composition:

Silica,	3·20
Phosphate of lime,	0·40
Carbonate of lime,	1·50
Phosphate of magnesia and soda,	2·90
	8·00 Jackson.

This manure contains considerable water. The same author found that 500 grains, dried at a heat a little above boiling water, lost 35 grains. The ash of the remainder, amounting to 143 grains, gave, on being burnt, 8·5 grains, of which 4·80 grains were soluble in water; the remainder 3·20, insoluble. Horse manure consists, then, when summed up, of the following parts:

Water,	357·00
Vegetable fibrin and animal matter,	135·00
Silica,	3·20
Phosphate of lime,	0·40
Carbonate of lime,	1·50
Phosphate of magnesia and soda,	2·90
	500·00

This manure stands high as a fertilizer, but is quite liable to be injured or to be lost by fermentation and the rapaid escape of ammonia. To prevent this, it should be mixed with a quantity of gypsum, which may be added to it from time to time; or if it could be placed in alternating layers with peat, an immense advantage would be gained: as usually left to heat more than half of its valuable matters are dissipated.

The excrements of the cow are regarded as less valuable than the horse or hog. However this may be, observation and experience prove that those of the cow, as they usually accumulate in the yard during winter, are really the most valuable for farm purposes; that either those from the hog-stye and which are left by animals fitting for slaughter, especially if fed upon grain, are better than yard manure. The excrements of the cow are composed of,

Phosphate of lime,	10·90
Phosphate of magnesia,	10·00
Peroxide of iron,	8·50
Lime,	1·50
Sulphate of lime,	3·10
Chloride of potassium,	traces.
Silica,	63·70
Loss,	1·30
	100·00

HAIDLEN.

The urine of cows may be supposed to vary with their food. According to SPRENGEL, 1000 parts contain 926·2 of water, the remainder consists of,

Urea,	40·00
Mucus,	2·00
Suppuric and lactic acids,	6·10
Carbonic acid,	2·10
Ammonia,	2·10
Potash,	6·60
Soda,	5·50
Sulphuric acid,	4·00
Phosphoric acid,	0·70
Chlorine,	2·70
Lime,	0·60
Magnesia,	0·40
Silica,	0·40
Manganese, iron, etc.	0·10
	100·00

The urea is composed of carbon, hydrogen, nitrogen and oxygen. In fermentation this substance is converted into ammonia and carbonic acid; hence, this valuable matter is dissipated and lost in the chemical changes which this fertilizer undergoes, unless it is mixed with some absorbent, like gypsum, marl or peat.

There are undoubtedly greater losses sustained in this country by neglecting the liquid excrements of animals than by any other parts: but since the attention of farmers has been directed strongly to this subject, and since, too, the examples of our neighbors in Europe regard them as their most important fertilizers, they are generally taking measures which are more or less effective for preserving them for use. It is indeed a very simple process, requiring only absorbent bodies, which are within the reach of almost every farmer, as peat, muck and plaster or marl and charcoal, or mixtures of all of them; or else tanks, so constructed as to receive them directly and to which a little sulphuric acid might be added, by which sulphate of ammonia may be formed, which will fix the most volatile part. The view which economical writers have taken of the subject is undoubtedly the correct one, viz. that their waste and loss is equivalent to the waste and loss of a certain amount of corn and meat, or if the farmer resorts unnecessarily to the purchase of guano to supply those wastes, it is equivalent to the purchase of his corn and meat. How often is the farmer reminded that all the mineral ingredients of the food of his family and his stock, is derived directly from the soil, and that the soil can not, from the nature of its composition, remain long fertile, unless these fertilizers are restored to it.

According to BERZELIUS, the solid excrements of man yield, in 1000 parts, 850 of water, the remainder is ash which is composed of,

Phosphate of lime and magnesia,	100·00
Sulphates of soda and potash and phosphate of soda,	8·00
Carbonate of soda,	8·00
Silica,	16·00
Charcoal and loss,	18·00
	150·00

We find, therefore, that they are rich in phosphates and other valuable matters. I have no doubt that in the older parts of our country, where high cultivation is found profitable, all proper attention will ultimately be paid to the preservation of fertilizers.

The urine is composed, according to the same distinguished chemist, in 1000 parts,

		Solid residue in 100 parts.
Water,	933·00	
Urea,	30·00	44·39
Free lactic acid, lactate of ammonia, extractive matter,	17·14	25·58
Uric acid,	1·00	1·49
Mucus of the bladder,	0·32	0·48
Sulphate of potash,	3·71	5·54
Sulphate of soda,	3·16	4·72
Phosphate of soda,	2·94	4·39
Biphosphate of ammonia,	1·65	2·46
Common salt,	4·45	6·64
Muriate of ammonia,	1·50	2·23
Phosphates of magnesia and lime,	1·00	1·49
Silica,	0·03	0·05
	1000·00	100·00

The drainings of barn yards afford a liquid matter which, perhaps, is less rich than when the liquids of animals are collected in tanks secured from rain water. JOHNSTON, who has analyzed these drainings, gives the following as the result: an imperial gallon gives an ounce of dry solid matter and consists of,

Ammonia,	9·60
Organic matter,	200·80
Inorganic or ash,	268·80
	479·20

The inorganic portion, or ash, consisted of,

Alkaline salts,	207·80
Phosphates of lime and magnesia, with a little phosphate of iron,	25·10
Carbonate of lime,	18·20
Carbonate of magnesia,	4·30
Silica and alumina and loss,	13·40
	268·80 grs.

The object of the analysis is to determine how much of the soluble salts waste out of the heaps of barn-yard manure, when left exposed to the rains. It is evident that those drainings are equally rich as the pure liquid excrements, and when the yard is so situated as to drain from the premises they are most lost; and indeed the loss must always be great from volatilization. The greatest losses from these heaps is in the phosphates, which, of course, can not come from the urine, as it is too poor to furnish it. The drainings are still richer when the urine is mixed with the heaps or poured upon them. They are found to contain, in a gallon, 617½ grains of dry residue, rich in ammonia, which escapes freely when boiled, or when mixed with quicklime. This residue consists of,

Ammonia,	21·50
Organic matter,	77·60
Ash,	518·40

The latter consists of,

Alkaline salts,	420·40
Phosphates of lime and magnesia,	44·50
Carbonate of lime,	31·10
Carbonate of magnesia,	3·40
Silica and alumina,	19·00
	518·40 grs.

To save, in the most economical way, the drainings of farm-yard manures, no method has been found so effectual and cheap as peat, where it abounds. In many cases charred peat may be used. The great tract of peat and marl country, from Rome west, traversing the counties of Onondaga and Cayuga, abounds so much in these substances that they could be employed to the greatest advantage in increasing the amount of the fertilizers of the stables; that too much can scarcely be said in recommending the subject to farmers. The river counties also abound in peat. In the northern, it is equally common. There is, therefore, an immense amount of peat for agriculture in the State of New-York, which is not exceeded, probably, by any country in the world; and there is probably no method of turning peat land to so much profit as the application of them in the way and manner recommended. If the time has not yet come which

requires a resort to this method of increasing the manures, the period can not certainly be far distant when it will be regarded in its true light.

The rapidity with which farm-yard manure loses its weight is worthy of attention. It is found that while the water evaporates and rises upward, it carries with it what had existed as solid aliment. Obtaining the weight of ten hundred pounds of dry fodder, consisting of straw, hay, etc. it is found that it will produce from twenty-three to twenty-five hundred weight of manure. This, on exposure in the ordinary way, in yards, will be reduced in weight,

In six weeks, to.....	21 cwt.
After eight weeks, to	20 "
When half rotten, to	15 "
And finally, when perfectly rotten, to	10 "

One half, therefore, is found to have escaped into the atmosphere. The increase in weight by the process of digestion, is derived mainly from the water drank by the animal. The water which has been thus absorbed, dries out rapidly; some of it flows outwards by the pressure of the mass. If nothing but water passed off in the drying process, some gain would be obtained, as its bulk and weight would be diminished, and its transportation thereby facilitated. The decomposition itself is necessary; but the great desideratum is to effect these changes in the soil, where the volatile parts being disengaged, they will be obliged to pass through the earth, which being a good absorbent, detains them for the use of growing plants. The process of decay goes on slowly, as the temperature is less, and only a small quantity of those matters can accumulate in one place. This is the more favorable as more time is given for the perfect absorption by the soil. That the soil is an excellent absorber of volatile substances is proved by many direct experiments in the laboratory. It is, however, a fact familiar to most persons, and the practice of covering with earth a garment which has become attainted with an execrable odor, as that of the skunk, is well known in the country, and frequently resorted to, to purify them from the result of such accidents. This property of the mixed earths, is one of the most important, without which a very large proportion of the most valuable fertilizers would pass away, without benefit to the vegetation. The retention of water, too, is another property, without which plants would be unable to reach maturity, and ripen their seeds.

13. *Of Composts.*

To meet the wants of plants, compound fertilizers have been manufactured, which are designed to contain all the elements which they require during their stages of development. These artificial compositions must be based on a knowledge of all their leading constituents, and really of the relative proportions which are found in them. With this knowledge, it is possible to put together those substances which may be required for any crop.

The true way to form a compost is to select the base of the composition, which should be the most important matter in the constitution of the vegetable: this substance should be phosphate of lime. To this may be added those salts which contain the alkalies, sulphur, carbon

and nitrogen. Most composts are bulky, and consist of all the waste organic materials which may be found about the yards, barns and kitchens of a farm-house : hence weeds, leaves, spent ashes, soap-suds, crushed bones, decaying or putrid meat, waste fish-brine, together with peat and chips, saw-dust, chamber wastes, etc., may be all mixed in a depression in the soil, made impervious by a stiff clay bottom. Fermentation will ensue, and in due time a quantity of valuable fertilizers will be formed, at a trifling cost. Every farm establishment should have its compost manufactory, both on the score of economy and comfort, where every offensive thing about the premises may be deposited. Not unfreqently accidents occur with the stock, and for many causes a cow, ox or sheep die, which may be turned to some profit, if the carcases are properly covered and immersed in absorbent vegetable matters. All the ammonia and volatile products arising from decomposition may be saved from waste, and employed as fertilizers. The formation of compost may be frequenly effected by ploughing and collecting the turf of road-sides and mixing with lime or ashes. A rich loam may, in this way, be formed where the farm-yard is too distant to admit or warrant the transportation of the ordinary manures. Peat and muck beds are usually situated at a distance from the dwellings and barns. In order to make these ancient depositories of manure for the husbandman the most useful, the peaty matter should be thrown out first to dry ; it will lose its water, and one half if not more of its weight. When dried in the sun it is well prepared to become the absorbent of ammonia, carbonic acid, etc., together with any liquid wastes which it may be convenient to add to it. A fertilizer will take the place of water, and will also aid in the decomposition of the peat itself. It is well known that if dry peat is buried slightly in the soil, it will remain a long time an annoyance to the tiller of the soil. It is, therefore, essential that it should be in a changing state—a state in which decomposition is going on : it will then continue, and finally be resolved into nutritive elements. When peat and marl are both present, it is a still more fortunate occurrence ; and every husbandman who possesses such resources, should make his farm productive and profitable. The peat will supply organic matter, and, to a considerable extent, those forms of it which contain nitrogen ; usually there is a small percentage of phosphates in the marl, but probably additions of phosphates will be required, if the farm is devoted to dairying, or the production of the cereals. Bones, then, or the native phosphates, will be all that will be required to make such a farm a standard one, which will not suffer by comparison with the best establishments in this country or Europe.

OF CROPS AND THEIR CULTIVATION.

Northern husbandry differs from southern husbandry, in the variety of crops which are annually raised. This difference is found to exist when we compare those parts of the south where slave labor prevails exclusively, or rather where certain staple crops form the main object of the planter, as cotton, rice, sugar and tobacco. It appears to be proved that the black laborer, while in a state of servitude, has less power to adapt himself to a varied husbandry than the white laborer. There is a routine of work upon a sugar or cotton, or rice plantation, with which the

negro becomes familiar, and which he can conduct without a constant superintendence. It is an interesting question, which plan of field operations is the most profitable; whether the greatest profit is on the side of a multiplicity of products, or where it is confined to one staple and standard crop? It is true that there are casualties which might affect, for a succession of years, a single crop, by which the planter would be a constant loser, and each of the southern staples which have been named are known to fluctuate in value. But the question does not lose its interest when it comes home to the north, for here we may create a staple of Indian corn or wheat, or the attention may be turned to stock, or it may be directed to sheep or dairy husbandry, or to the raising of young stock by pasturage. I say the attention may be turned to either of these branches, exclusively; the question then would be raised, which plan of husbandry is the most profitable, that which confines itself to one staple or that which produces annually many and varied kinds? The liability of a failure in a crop, which if it happen strikes out a year's profit or year's labor, with its current expenses to be met, is a consideration which must have great weight in its decision: on the contrary, if several kinds of products are raised, the failure of one will not entirely blast the hopes of the husbandman; and so varied are the wants of plants of the different products, that it is quite rare and unexpected that a loss by an unfavorable season should affect the crops at large.

Questions of this nature are not of easy solution; they do not turn on a single fact—they have a varied aspect, and must be looked at under a variety of circumstances. Location is a point of much moment; the pursuits in the neighborhood of large cities are controlled by the wants of such cities; not entirely, perhaps, but they give shape to the general employment of men. Sheep, if kept, will be kept for their flesh; cattle will be fattened for the market; garden vegetables will require the attention of many; in fine, farmers will be employed, in the vicinity of large towns, in producing the immediate necessaries of life, in supplying the daily wants of those who are engaged in commerce, mercantile and mechanical pursuits. Under the control of such circumstances a varied husbandry will force itself upon the attention of producers. At a distance from the bustling scenes of a city and the busy haunts of men, the farmer is free in his choice of subjects of culture. It is there he may turn his whole attention to wheat or maize, sheep or cows, horses or oxen. But is there encouragement to confine his attention to one subject? There is this in favor of it, he soon learns to do this one thing excedingly well. Experience guides him in rearing sheep, cattle or horses, in raising meat or clothing. On the one side, he has but one thing for market, and it may be glutted; on the other, again, if the market is glutted with one kind of produce, he has another which he may try, and another still, if the second fails. Buckwheat, oats, Indian corn, potatoes and fruit, may all be sent to market, and it would be very strange if one or more did not return itself upon the owner with profit. There is another consideration, too; the soil of most estates has a variability which favors a varied husbandry, and hence, in order that the farmer may turn his patrimony to the best account, and make it tell the highest figures, he must take advantage of the qualities of his soil.

ON THE CULTURE OF THE CEREALS.

The cereals, as a class of vegetable products, have the highest claims on the husbandman: they constitute the main resources for bread, and civilized life would lack an essential element of support, if it was deprived of them. Bread is a token of civilization; the pounded corn, mixed with water and roasted upon a flat stone, is the first step towards a better condition; a cornfield is the first indication that the chase of wild animals for subsistence will be abandoned—it foreshadows the fixity of a tribe or people, and the idea of property in lands and tenements. The perfection of cultivation, however, is left to a period of perfect rest and undisturbed possession. The cultivation of the cereals is still imperfect, though cultivated in patriarchal times. The progress of cereal culture, however, I shall not stop to give in detail; my present work is to give the present experience, to speak of the best practices of the best cultivators, and the principles upon which their cultivation is founded.

Indian Corn.

Indian corn does not demand a special soil, though it does not grow equally well upon all: what farmers call a loam is preferred to sandy or clay soil; yet good crops are obtained upon both. The essentials to the best crops are perfect seed, from near the butt of the ear to a point beyond the middle, always the kernels one inch and a half from the tip. 2. A deep ploughed field, made mellow. 3. Early planting. 4. Seasonable hoeing and the proper use of the cultivator. 5. The application of fertilizers.

The seed should be culled from the earliest ripened ears. Attention should be given early to this point. The least taint of smut or mould is sufficient cause for the rejection of any ear for seed. When the ears are selected, the husk should be stripped down and used to suspend them until dried, or perhaps until wanted for use.

The field should be ploughed rather deep. The question of subsoil ploughing turns upon its condition. An old field will be improved by it; in a new one it is less necessary. A wise farmer will give his field an even surface, and will mark out the course of his rows with a light plough. A field, when wet, should not be ploughed, hoed or drilled for corn or any other purpose: the soil should remain and not be stirred until dry. Still the time for ploughing for Indian corn is when the field is dry: the time for planting is when the soil has attained a temperature of 60° Fah. The temperature should give an impulse to the germinating power of the seed. They will rarely rot if germination begins, and though the blade may not issue from the ground at once, still it will appear, and though a frost may cut it down, it will yet live, and the roots will increase in extent during the whole period it is lingering in its upward growth by the spring cold. It will mature at an earlier day, and become a sounder and heavier corn, and escapes the autumnal frost. These are the advantages of early planting. It is to be understood, or should be well known, that seed which is perfect is far more likely to germinate than seed which has just ripened, and when its vitality is only feeble; such seed will not bear an early planting, it will surely be lost; hence, where the vitality is doubtful or feeble, a later

day for planting should be selected. Of late years mature seed has been abundant. In 1816 it was scarcely ripened in New-England. The greatest success follows from planting an early variety; it is of little benefit now to try to acclimate late varieties: the earlier kinds will adapt themselves to the length of the season; if very early, as the Canadian, it will soon begin to ripen later, and with little loss of time it becomes acclimated to the spot. The season of planting for 1850 began late through the whole country, in the south as well as north; but it has terminated every where with a fine crop of Indian corn. Yet there has been an apparent fitfulness in the distribution of rain. The same locality has furnished instances in small sections of country, where rain has fallen quite seasonably, and yet a mile distant the fields have suffered from a cold drought. Such has been the case for several years, and yet maize has generally yielded a profitable return.

Corn is impatient of weeds, and refuses to grow where the light is obstructed, and where its roots are robbed of nutriment; hence hoeing is one of the most essential of the operations required in its cultivation. As long as corn has been cultivated, still great improvements have resulted from accurate observations, during the last twenty years. Formerly, it was hilled most thoroughly, and to this day, after the lapse of fifty years, it would be possible to discover where the hills of corn had grown. Now experience proves that hilling is rather injurious than beneficial; that it is not required to sustain it against the winds. Where it is hilled for this purpose, it is forced to rely upon the strength of the stalk to support it, while if not hilled, it is sustained in a more favorable manner by its firm fibrous roots. The great object in the use of the hoe and cultivator is the destruction of weeds and plants of a foreign growth. Clean cultivation is the rule, and to it there is no exception. Much labor may be saved, first by planting after a well hoed crop of potatoes, and the use of those fertilizers which either contain no seeds, or where their vitality has been destroyed. Much of the labor of farmers arises from this neglect; it is far easier to destroy seeds in the manure heap than in the field.

The kind of manure which suits corn is that from the farm-yard. There are, or may be mixtures of the excrements of the horse, ox and swine. Those of the horse, if not properly secured, may be of little use; if mixed with gypsum, it will be doubly valuable. The application of manure to the hill is the best, especially if the land is loose and sandy; if a consistent loam, it may be spread broad cast. But one of the most useful applications is the wood ash, after the first hoeing, and applied to the amount of a handful immediately before a rain. From the ash both phosphates, potash and lime will be obtained, and as the application is about the plants, the good effects will be felt by the plants themselves.

Of cow manure, to make up this amount of inorganic matter, about twenty tons of the excrements of the cow will be required; if those of the swine can be obtained, about one-third less will supply the requisite amount. The manure of swine is richer in phosphates than those of cows: observation proves this, as well as analysis. The lime, soda, potash, magnesia and silica are about the same in each. The greenness and vigor of corn is very striking, where the manure of the hog is used, when compared side by side with that of the horse or cow. But these kinds of fertilizers may be made equivalent to each other, by the

addition of native phosphate of lime or bone earth. An addition of twenty-five pounds of the former (phosphate of lime,) to every ton, will be rather more than sufficient to equalize the differences between them. This mineral can now be obtained, and its use will mark an era in the husbandry of any district where it is employed. It may be used as the basis of all composts: it will equalize the value of the different compounds, and diminish the expense of high cultivation.

But there is an element which must be taken into account, when we undertake to estimate the comparative value of manures; it is the food from which they are derived. This element has been referred to. For example, if the cow has been fed upon timothy, or the common mixed dried grasses, the amount of silica in the excrements will be five times as much as if they were fed upon clover. This must follow from the composition of these plants; the former being very rich in silica, while the common red clover is poor. See volume second, where the composition of each is given. So if fed upon grain, leaves or any cereal or substance rich in phosphates, the composition will vary still more. It is, therefore, by approximation only that we can arrive at the value of fertilizers; and what increases the difficulty is their mixed condition as it regards their source, and as it regards also the food of the animals from which they are immediately derived.

An early supply of these essential elements of grain is important. The leaves and stalk may be said to ripen first, and it is not until their ripening that the plant proceeds to the fulfilment of a higher duty—the production of seeds, for the continuance of the species, or the production of the grain for the sustenance of man. When this is done, the forces of the plant are directed, or should be, to this end, and it would seem that when the period has arrived, or time has come for this, if the leaves are yet immature, the forces of the plant are divided between the growth and perfection of foliage and the production of fruit.

An acre of corn will require an amount of one thousand pounds of inorganic matter to be added to it, where the acre has been reduced by cultivation below the ordinary standard of fertility, or where only twenty-five bushels of corn could be expected upon that area. This is rather more than twice the amount which a good crop would remove from the acre in its stalks, leaves, husks, cobs and kernels. It is always necessary to add twice the amount which a crop is known to remove. This is a good rule in any case, in the older sections of the country, where fertilizers are depended upon from year to year; of course in the new lands, where the original fertility is unimpaired, this rule will not apply. The determination of the amount of inorganic matter may be obtained by consulting the analyses of the fertilizers from the different kingdoms. Thus in dry peat there is 5 – 8 per cent of white and pure ash, or inorganic matter. The excrements of the horse contain from 8 to 9 per cent, nearly 3 per cent of which is silica in a soluble state, and which, on this account meets very well the wants of maize. I am thus particular in stating these facts for the purpose of directing the attention of farmers to the importance of knowing how much they are taking yearly from the fields, and also how much they should return to them.

It will be observed on consulting the analyses of Indian corn, in the second volume, that different varieties require different amounts of certain elements. While all varieties, and they are very numerous, require potash, soda, silica and the phosphates, they do not contain them in equal quantities or proportions. Sweet corn, which is an anomalous variety, contains an excess of dextrine and albumen, while white or yellow corn contains them only sparingly. The earthy and alkaline elements of corn are potash, soda, lime and magnesia, which are mostly in combination with phosphoric acid. The organic salts, as the crenates and allied compounds, are also only feebly represented; this is certainly the case with the kernels of all the cereals; the herbage gives an effervescing ash, indicating the existence of carbonates, which originally may have been in the condition of organic salts. Other elements also exist which are essential to the composition of the plant, viz. iron, chlorine, sulphuric acid and silica. Magnesia is also easily detected in the foliage, and seems, from its frequency, to be constant. There are at least ten mineral elements in the corn plant. Oxygen, nitrogen, carbon and hydrogen, form also several combinations; oxygen is united to silica, to iron, phosphorus, sulphur, lime, magnesia, potash, soda, hydrogen, carbon and nitrogen: some of these, however, as they occur naturally, are always in combination with oxygen, as potash, soda, lime, magnesia and silica. The substances which exist in the largest proportions in the kernels are the earthy and alkaline phosphates. Of the organic bodies starch is largest; sugar and extractive matter, and constitutional water, stand next; oil, gluten, albumen, casein and dextrine, from one half to 24 per cent. The dextrine being in very large proportions in sweet corn, is indicated in all those varieties which shrink, or are indented. To produce seed—to develop the grain, requires a large amount of herbage, a great extent of expanded tissues, whose functions are entirely subservient to this end. Scarcely any starch can be detected in this part of the plant; it is sometimes found in the stem: a substance closely allied to it, in composition, forms the tissue; this is called cellulose.

The value of the maize is not confined to the ears or grain; the entire plant is valuable, and it is highly probable that a greater amount of seed can be obtained from this than any plant we now cultivate. For nutriment it compares well with the grasses, and for the amount of crop it exceeds them all, when sown broad cast, or in drills, for fodder. The poor man may support his cow upon corn fodder, with little expense, by soiling with maize; and the rich farmer can also soil for his flock of cows, and derive as much if not more profit than if pastured at a distance. The leaves and stalks furnish sugar, chlorophyl and wax, casein and albumen. Fibre forms the bulk of the vegetable, as if to show that there must be a substance to make bulk and create a moderate tension of the alimentary tissues.

Maize is attacked by a peculiar kind of smut; it fixes itself upon all parts of the plant; the kernel is transformed into a black smutty sac; the cells of the leaves and stalks are swollen out and form tumors, which are filled with this substance, and which finally burst, attended with an escape of a black powdery juice. This smut is a real plant, developed only in and upon the maize. The question, how its productive germs find their way into the tissues, has not been satisfactorily answered; but the indications are that these spores find their way into

the plant through the ascending sap. They there generate in the tissue where they happen to lodge, or any where upon the stalk or ear. This fungus becomes troublesome, and where successive crops are raised upon the same field, the smut increases in quantity: no remedy has been discovered. The evil, however, has not been felt as a great one; still I have known almost every hill in a garden plat infected with it. How tenacious of life the spores may be is not determined. New grounds are not at all, as I have seen, affected with smut, while in old, it is common. It is called the Maize Brand, or Uredo mais. All infected stalks should be removed from the field and burnt; it seems to be the only way of stopping effectually this smutty infection.

It has not been a part of my plan to enter minutely upon the details of practical husbandry. There are general principles which lie at the foundation of all kinds of culture. These general principles are necessarily simple and few: but there are necessarily differences in practice, in different parts of New-York, which do not conflict with them. These minor differences result from location and other circumstances. No where is it supposed that a crop of corn can be raised, unless the ground is duly prepared; neither can a crop be expected, unless the soil has fertilizing matter in it; and, lastly, no one expects to be successful in the midst of weeds. The time of planting, the kind of fertilizer, the special mode of managing the young and maturing plants must differ somewhat in the six agricultural districts. What would be good practice in the first district, might succeed only indifferently in the fourth. But the practice and desire of attaining the different modes of culture in these districts is laudable and highly useful. How much, too, is due to the season: even its effect upon the fertilizer itself is great. The forwardness of a crop at the commencement of a drought, is another important item to be considered, in estimating the value of different modes of culture. We may regard the country in a condition in which we shall ever be subject to a deficiency of rain during some parts of the season of a maturing crop. One great desideratum in growing a crop, of corn especially, is to push it forward rapidly in the earlier part of the season, that the ground may be shaded by the plants, provided the rains should be deficient to meet the wants of vegetation. It is for this reason, in part, that corn should be planted early. The importance of this view is sustained by observation. Compare two adjacent fields, one of which is well advanced by the first of July, and the other is but a few inches high, at most it is too sparse to shade and protect the soil from drying: the first will stand a severe drought, without sustaining much injury, the other will be nearly destroyed. The safety of the first arises from two causes; the protection of the ground from the direct rays of the sun, and the greater amount of dew, during the night. Soil which is protected by a crop, even though a stiff clay, will rarely crack, if covered with a dense vegetation, as a good crop of clover, unless the drought is extreme. The difference is seen at once in the same field. Where, for instance, the farmer has seeded down a field of this description, that part where the seed has well germinated and grown will protect the soil, while the part which has winter killed will crack, and present a rough and naked aspect, with the appearance of barrenness. It is true that, frequently, late planted corn presents to the eye very little difference from the early. When harvested, however, the real dif-

ference is manifested in the soundness of the grain of the early planted, the filling of the ear, and its weight. As great a measure in the cob may, perhaps, be obtained in the late planted as the early; and if the season is sufficiently prolonged, as it often is, then the late planted may be equally good with the early, but this is fortunate. The object with the farmer is to secure himself against contingencies, if possible—against droughts and frosts, which, though he can not control, he can not ward off, yet may be prepared for them, which, with him, may be just as well as though he could really control them: he, as it were, commands nature by obeying her laws.

Culture of Wheat.

There seems to have been a greater diversity of opinion in wheat husbandry than in that of Indian corn. The preparation of the soil, of the seed, and of the period of sowing, each find diversities of management, with different experienced wheat growers of New-York. But there are a few important points upon which farmers agree. Taking all the testimony in regard to the preparation of the soil, it stands as follows: 1. The furrows should be run deep, not less than ten inches, and many are in favor of using still the subsoil plough. 2. The crop should be manured indirectly, that is by clover fertilized by plaster, and what yard manure can be obtained; the seed to be well washed with brine, and dried with plaster or ashes, in which it is rolled. 3. The quantity of seed not to be less than one and a half bushels to the acre, and not to exceed two, unless it was threshed in the machine, when allowance has to be made for injured kernels. 4. The seed to be drilled in: the experience both south and north confirm the expediency of drill culture, both in the saving of seed and the danger from frosts, and the value of the crop. The foregoing are points which have been well agreed upon by New-York farmers. The rotation of crops preparatory for wheat I find a diversity of opinion. Barley and Indian corn have sometimes preceded wheat; but this is a violation of a good rule; clover or peas are far better according to the testimony of good farmers, and it stands to experience, from the composition of the respective crops. Clover, however, is preferred by a majority. The pea root is less suited to the wants of the succeeding crop, though, so far as exhaustion is concerned, it is unexceptionable. A good crop of peas, intermixed with a few oats, gives a profitable crop for feeding swine and horses; but a full crop of oats would exhaust a soil, it seems, too much, and hence violates a good rule in husbandry: yet if the farmer can command fertilizers, I can see no objection, for his reward exists in two crops instead of one.

The natural soil which is adapted to wheat is a clay loam, or a stiffish clay, and it is remarkable that good crops are raised upon a sandy loam. It is not, therefore, a crop whose culture is confined to a single kind of soil: the argillaceous soils stand the culture for years, while the other requires more labor and more manure. In some of the best wheat soils of Middle and Western New-York, nature has provided a reserved soil which comes into use in the progress of cultivation. Indeed a portion, and a large portion too, of this district has improved in its ability to bear wheat, since the first settlement of the country.

The difficulties of raising wheat, however, do not lie with the soil; insects are the great

hindrances to this crop. In the east the wheat fly has destroyed entire fields: in the south the Hessian fly is a great nuisance; the grain is not attacked directly, by this kind of fly, but the stalks are broken and weakened, and much seed is lost. The rust is an evil which can not be shunned: what may be effected by adopting certain varieties for culture is not yet fully determined. The softer and less silicious stems are more subject to rust than the harder and stiffer kinds. There is a change in regard to the practice of wheat growers; formerly the Mediterranean wheat, which is less subject to rust and the attacks of the Hessian fly, could not be manufactured into good flour; but, within a few years, experience in grinding has enabled all the good western millers to manufacture a fine flour from this variety, and hence it is likely to prove that proof varieties may come into cultivation, which have been objectionable on account of the character of the flour. So much has been said already of the composition of wheat and its straw, that I shall dismiss the farther consideration of the culture of this important crop. I am satisfied that New-York possesses a climate and soil as well fitted to wheat as any of the western States, and that she can still compete successfully with them in the growth of this grain, and in producing one of a quality superior to them.

Cultivation of Barley.

Barley may be cultivated with profit at many places, where wheat is too uncertain to warrant the expense of its culture. It succeeds in the mountainous parts of New-York and New-England, upon the primary soils, which are generally strong, particularly those which are based on mica slate. The field is to be deeply ploughed and sowed in April, with three bushels of seed to the acre: ordinarily, on land in a common condition thirty loads of barn-yard manure to the acre is sufficient.

The composition of barley differs from wheat in the presence of more silica and lime: lime is one of the elements of straw. It seems to be a plant more hardy, and less subject to diseases and accidents, and especially less liable to the attacks of insects, than wheat. Ground with buckwheat, it is an excellent food for working horses. The crop is very uniformly profitable; it yields upwards of fifty bushels to the acre; the bushel weighs forty-eight pounds.

Cultivation of Rye.

Rye is still more hardy than barley, and will grow well on sandy soils; on the lighter gravelly or sandy loams, with slaty rock, the quality of rye is superior to that grown upon a clay loam. The best rye, however, is raised upon new lands: upon a burnt fallow, when too stony to be ploughed, rye may be sown, and raked or hoed in; good crops are often thus obtained for two or three years in succession. The bread of rye flour retains its moisture longer than wheat. It is sparingly used, compared to what it was twenty years ago: very little wheat flour was consumed in New-England, in the country towns, at their early settlement; wheat has now usurped its place. Rye is heavier than barley, by some ten or twelve pounds to the bushel, having nearly the same weight as wheat. The gluten of rye is less fibrous and glutinous, and hence forms a light raised bread with more difficulty. Boussingault states that

the proportion of straw to grain is as 100 to 50, or nearly that. It yields less to the acre than barley, varying from ten to twenty-four bushels. The sandy plains of Sheffield and Windsor, in Connecticut, where rye is the main crop which is produced, the yield is frequently less than fifteen bushels to the acre; more generally ten bushels. It is of a fine quality.

Cultivation of the Oat.

The grain of the oat is small, but is highly nutritious. The oat is an exhausting crop, though it is small and light; yet the straw being also rich in nutriment, compared with wheat, a crop of it necessarily takes off a great amount of the expensive matters, as the phosphates and alkalies. In this climate it is a crop which rarely fails: it requires more rain, or bears rain better than wheat, and may be sown upon wet land; it yields from thirty to forty-five bushels to the acre; its weight is thirty-four pounds to the bushel. Oats do not require so deep ploughing as wheat and maize: it is sown about the middle of April, and ripens by the first of August; three bushels of seed are required per acre. It costs about ten dollars per acre to cultivate it properly. It may be manured directly, and ten loads of barn-yard manure will suffice. It is a good crop to follow potatoes. The relative proportions of ash, grain, water and straw, may be stated generally, as follows:

Grain,	100·00	to	100·00
Water,	9·41	"	10·40
Ash,	2·39	"	2·50

The proportion of husk to kernel,

Husk,	29·31	29·05
Kernels,	70·68	70·94

Percentage of water and dry matter, etc. of the kernels or grain,

Water,	9·41
Dry,	90·58
Ash,	2·47
Calculated dry,	5·24

The oat is rich in starch, but what makes it so valuable for feeding is the large amount of the glutinous principle, or avenine. It is also rich in oil, which has a fine yellow color and a fragrant odor. There is, probably, no crop so easily raised, which is more valuable for food for animals than this; it requires a clean soil and absence of weeds: it is not attacked by insects, nor liable to rust like wheat. A species of smut is found in almost every field, but is not so prevalent as to become a scourge, or to materially diminish its value. The oat is fitted, constitutionally, for a wide range of territory, endures a wet cold season, and may be cultivated higher and farther north than wheat or maize.

CULTIVATION OF POTATOES.

Probably no crop has caused so much attention and talk, for the last ten years, as the potato crop. Being adapted to a cold moist climate, and yielding a large amount of nutriment, it has been widely cultivated, and depended upon as food by large communities. When a crop of this description is cut off and fails generally, so as to create want, it becomes a loss which can not but be felt by the nations at large.

The potato is easily cultivated, and requires, probably, less care than most crops; yet it well repays a careful and thorough cultivation. The true mode of cultivating this crop is to prepare the ground by deep ploughing; it gives opportunity for the extension of the fibres upon which the tubers grow. Fermented manures are better than the long unfermented, and upon a mellow soil, wood ashes is more valuable than other fertilizers, as it furnishes the supply of potash which the young tuber requires. Rich or nitrogenous manures, and the saline compounds generally, increase the growth of vines, without promoting the development of the tuber. The tubers have multiplied greatly in variety; and it is a matter worthy of notice, that a diversity of excellences are borne by these varieties. The ripening of potatoes has not received the attention it deserves. If it has attained a common size it is often regarded as fit for the table. But it is with the potato as with apples and other fruit, there is a state of ripeness and maturity required before it is eaten, if we would secure and possess its better qualities. The Merino, for instance, is a spring potato; others are winter, and others still are autumnal. The Early Shaw is one which attains its goodness in the autumn, and retains its excellence till the succeeding spring; it is not, however a good producer, and its tubers are rather small.

The great drawback to the cultivation of the potato is its liability to rot. For nearly ten years this tendency to be diseased has been on the increase. It has varied, however, in its intensity, but more or less disease has been annually observed. It has assumed, at some points, great energy, so that whole fields have been so thoroughly infected that the sound potatoes were not numerous enough to pay for digging.

The investigation of the nature and cause of the malady which has destroyed the potato has employed as many minds as the cholera itself; and, like the cholera, the cause is still unknown and mysterious, and probably will continue to be so—that is, the real true cause. Some have imagined that it is an insect, which poisons the sap; some supposed that it was to be found in the constitution of the soil; others, in a change which had been brought about by the long cultivation of the tuber, without renewing the plant from the seed; that in reality its vital powers were on the wane, and that its vigor was about becoming extinct. All these views, however, have fewer advocates now than formerly. Those who thought the cause existed in some defect in the soil, proposed to remedy it by the addition of various elements; and those who thought the potato was worn out through long cultivation renewed their tubers from the seed, and even sent to the land of its nativity for the vigorous plant, upon the mountains of Chili and Peru; but these failed. The character of the tuber, however, is important, for some varieties have escaped, in a measure, when others have been very generally diseased. My own views

of the malady have been, from the beginning, that the cause is atmospheric, and that certain states of the weather have been, and are the proximate cause of the potato disease. If so, it may be asked, why are not all fields equally affected? inasmuch as all are equally exposed to the action of the weather. So too, I might inquire, why does not the cholera affect the people of a country alike? At some points it seems to be intensely active, while at others it is scarcely felt, and others escape entirely. That it is connected, as a sequence, with certain states of the weather, appears to be sustained by the fact that the disease is quite uniformly a sequence of that state; it appears to follow certain changes. One of the signs of an attack of the malady is the desiccation of the leaf and stem; and again, it attacks the unripened crop. So again, other vegetables are affected in their foliage in the same way: of these vegetables the American elm is very generally attacked; its leaves begin to wither and dry upon their edges, and sometimes all the leaves upon a young and succulent branch dry and crisp, when the limb dies. I have seen the plum, maple and horse-chestnut affected simultaneously with the elm and potato plant, and to manifest those symptoms immediately after a certain condition in the state of the weather had passed. This state is marked by a peculiar sultriness, and sharpness of heat, which has followed almost immediately upon a rain which had supplied vegetation with an abundance of water. The rot is a sequence of this state; it certainly is not an antecedent. This view of the matter explains to us how all the investigations have failed: that they should fail is plain to every reflecting mind. The time may possibly come when the peculiar cause of cholera may be detected by experiment. Physicians have sought for the cause by dissecting the dead; but it is evident that it can not be found here, any more than chemists have been able to find the cause of the potato rot by dissecting and analyzing the tuber. What, however, is discovered are effects of disease, in both cases; not, however, a trace of a cause can be seen. The disease is really a gangrene of the cellular part; it is in the walls of the celluar system: the starchy part is unaffected. This fact I determined the first season that it appeared in this State, and the foregoing views were adopted at this early period, and have been stated repeatedly in the various discussions in which I have taken a part. My observations have been directed to facts, as they have transpired every season since the appearance of the gangrene, and I have had an increasing conviction of their truth, or rather increasing evidence of their correctness every year. It is important that we find something upon which to form an opinion; we know better what to do, and what to withhold. We shall not attempt to destroy insects, expecting thereby to rid us of the malady.

Observation is valuable, as it will enable us to diminish the amount of disease, though we may be unable to escape it entirely. This is apparent from, 1. The fact that certain varieties, the dark colored for instance, are less subject to gangrene than the white. 2. By the early planting of any kind, it stands a better chance to escape it, than by late planting. 3. Clay soils, which are moist or wet, favor the gangrene, and sandy and gravelly soils are safer of the two. 4. Nitrogenous manures, applied in the hills, favor the development of the gangrene. 5. The use of wood ashes as a fertilizer. These five facts are important, though the observation of the rules which flow from them may not save us entirely from the disease; the gene-

ral experience is, and it is favored by the nature of the case, that much is to be gained by observing them. This year, 1850, I planted a very dark variety of potato, which I had obtained two years since. It was planted as an outside row of a patch of the Early Shaw. This patch was lost by the gangrene; it was not worth gathering. This outside row, however, was found to be free from disease; some three or four potatoes partly rotten were found; whether they were the old seed could not be determined, but the rotted ones were so few that no notice would have been taken of them, had I not been upon the look out for diseased ones. Two other kinds were planted upon the same patch, for trial, and which had the reputation of being proof against gangrene, but they were entirely destroyed; they were not as good as the Early Shaw, a variety which I have found very excellent in quality, as well as ability to resist the disease. This patch, however. was soaked several times with water, which stood upon it for two days after the cessation of rain, so that there was every reason to expect the result I have stated.

The strong points in the evidence that the disease is a sequence to certain states of the weather, are the very constant results which have followed those states, both as it regards the potato and other vegetables. It is a mode of reasoning which would be regarded as legitimate in other cases, and to which it seems we may assent, and especially where there are no other proximate causes which have an equal claim to our belief. By far the greater number of the causes which have been suggested have been entirely disproved by observation and experiment.

The subject might be discussed at length, but I deem it sufficient to state briefly the views which I have entertained, and which have become fixed in my mind, and the more strongly in consequence of a repetition of the same facts, followed by the same results. The cultivation of potatoes, carrots, beets and rutabaga, require essentially a mellow soil; but none of these, except the potato, are subject to disease, and hence, when it is designed to feed stock it will be safer to raise a greater proportion of them of the tap-rooted vegetables, to replace the potato. It is true that the beet and rutabaga contain rather more water, are not so good, really, to sustain and fatten stock; yet, for the purpose of change, and to obviate some of the effects of hay or dry food, they form an important addition to the resources of the farmer in wintering his cattle. In a mellow, rich and deep soil all of these tap-rooted plants yield immense crops. In hard impervious soils they contain but little farina or nutriment, and much tough fibrous matter, almost useless as food, or for any other purpose. High cultivation, therefore, is far the most profitable course to be pursued in the cultivation of roots. An acre should yield from 900 to 1000 bushels.

CULTIVATION OF FLAX.

The whole plant contains expensive elements, it therefore exhausts the soil. The lint, the woody fibre and the seed, are rich in phosphates. It is less exhausting, of course, when raised for lint, and is not suffered to stand till the seed is ripened. The adjustment of the soil to the production of the best kind of flax is more difficult than the preparation for corn. It requires manure, but it should not be over supplied, as in that case the texture of the lint will be coarse:

indeed a finer fibre, when the seed is thickly sown, may be obtained upon meagre soils. A clay loam may be regarded as the best adapted to flax. As in other cases, when the seed is small, some peculiarity must be adopted in sowing it. The land should be ploughed with a light plough, and laid in fine furrows; after which it should be dragged evenly, with a light harrow, when the seed sown should be bushed in, and pressed down with the roller. Upland is far more suitable to the production of flax than meadows, especially meadows which are situated in vallies and lie nearly level. The roots of flax do not penetrate deeply; indeed it seems to grow in the most superficial manner. The composition of flax indicates that the manures the most suitable to the growth of flax are the mineral. The lands of Rensselaer, Washington and Columbia counties are, many of them, adapted to the growth of flax: even those which are regarded as poor, yield fine crops, with proper care and attention. Toward the tops of the ridges of the Taconic ranges much flax has been hitherto produced, while the richer alluvial lands have been devoted to the cereals. In the excellent essay on the cultivation of flax, by William Newcomb, of Pittstown, Rensselaer county, he remarks that a rich loam is the best land for this crop, and he says it will grow on almost any soil but a sandy one, provided it be high and hilly. In low lands it is subject to mildew, which is of two kinds, a red rust, which destroys both seed and lint, and a black rust, which destroys the lint only. The seed is to be sown as early as possible in the spring: one bushel to the acre is regarded as sufficient. One great and essential point to be secured, is to have a clean soil, or freedom from weeds; care then should be be taken to use such fertilizers as are free from seeds, and to apply them to a preceding crop, as potatoes or corn, or any thorough hoed crop. I have stated that the composition of flax indicates the application of the mineral manures. The following will be found a good one: phosphate of lime, half a bushel; plaster one bushel; ashes one bushel. These are to be intimately mixed; it will suffice for an acre. Mr. Newcomb recommends plaster, one bushel; common salt and wood ashes, one bushel each; to which may be added one bushel of slaked lime. If phosphate of lime is omitted, there should be two bushels of wood ashes to supply the plant with the phosphates; and when plaster is used there is less necessity for using slaked lime. The yield of lint should be, from one acre, 350 to 375 pounds. The weight of a crop, per acre, amounts to 3000 pounds.

It is not so difficult to raise flax as to rot it properly, or to expose to the weather or atmospheric agents to such an amount and degree, as shall give brittleness to the woody and internal part, without injury to the fibre or outer coat, called the lint. The old method, is that of spreading it on a meadow, where it can remain undisturbed, until the fibre will separate from the stem. The degree of change, when thus exposed, is tried or determined by breaking it in the hands. Another method is to immerse it in water,: the advantage which water rotted flax has over the dew rotted is, it is stronger and less subject to mildew. If the flax is exposed to the weather it is exposed to attacks of fungi and cryptogamous plants; mildew is but a fungus, which seats itself in the fibre, and weakens and renders it more liable to attacks after it is manufactured. When immersed in water it is protected by that element from the adherence of the spores of the fungi. To water-rot flax, it is well bound in bundles; it is ready then to

be perfectly immersed in still water: a vat is a better mode than a natural pit, into which the water may flow, and when ready be drawn off. The time which it is to remain varies with the state of the weather; if warm, the process may be completed in five or six days or a week; if cool, or cold, it may require a month. The same method is employed for determining the time when it is to be removed from the water as when it is rotted on the ground, viz. by trial; if the fibre separates from the stem readily, it is ready to be removed, when it is spread out to dry upon the meadow. It is evident that where the time is uncertain for the process to be completed, that trials of its state and condition should be made daily, after the first week, or first five days.

After the preceding was written, I observed that there was appended to the article of Mr. Newcomb an analysis of the flax and seed, by Johnston. By reference to page 303, volume two of the Agriculture of New-York, it will be observed that flax is, as has been remarked already, an exhausting crop. My results may be relied upon, as care was bestowed upon the process pursued in the analysis. It grew in Pittstown, upon slaty soil, and one which is naturally fertile: lime, in combination with organic and phosphoric acids, exists in large proportions; potash exists also in large percentage; sulphuric acid and soda are also in large proportions for these elements. In flax seed, chloride of sodium is an important substance, so that salt, as a fertilizer, is adapted to and suitable to the flax plant. There can be no better rule, in preparing fertilizers, than to be governed by analysis; and analysis shows that the fertilizers which I have given meet the wants of the plant better than ordinary barn-yard manure. It is stated that grass seed takes remarkably well after flax, and for this fact it is supposed that flax does not exhaust the soil materially. This is not, however, a sufficient reason; the shading of the soil, the extraction of the flax by the roots, which opens the soil so freely and evenly, favors the germination and rooting of the seed. For the germination of seed, and its rooting, it is not so essential that the soil should be very rich; and soil which has been well prepared for this crop, it is not expected that a single season will exhaust it. But I would never discourage the culture of a crop because it is exhausting, when its value is in proportion to its expense. We have such an abundance of fertilizers that crops of this kind may be cultivated far more extensively than they are, and indeed should be.

CULTIVATION OF HOPS.

The cultivation of hops is attended with considerable expense. In the first place, the ground requires deep and substantial ploughing: in the second place, the field must be heavily manured, with the best the barn-yard affords, which must be harrowed in. The plants must be set from six to eight feet apart, and these must be sustained with poles from fourteen to sixteen feet long, set firmly in the ground. The gathering of the crop or picking the hop is troublesome and expensive. The drying of the gathered hop requires a separate building, and experience to perform the drying properly. Notwithstanding the expense and trouble of cultivating the hop, it has been a profitable pursuit, a productive husbandry. The hop, as it requires a rich, mellow soil, and is supplied with extensive roots, which penetrate deeply, may be regarded as

one which takes the expensive fertilizers. The soil, however, when the field is changed, after eight to twelve years culture, contains a large amount of vegetable and mineral matter in combination. It is not exhausted even for the hop, and the cereals may succeed it.

Hop leaves have the following constitution :

Silica,	24·40
Phosphates of lime and magnesia,	19·35
Lime,	20·00
Magnesia,	2·33
Potash,	10·50
Soda,	4·17
Sulphuric acid,	1·50
Chlorine,	1·75
Carbonic acid,	15·01
Organic matter,	2·00
	100·61

The capsules differ somewhat from the leaves : they contain thirty per cent of the earthy phosphates, less potash and lime, but about the same proportion of silica, though rather greater. The lime amounts to between five and six per cent. A full supply of bone earth, native phosphates, or those fertilizers rich in phosphates, is important, to secure a full development of the hop.

To be more particular in describing the details of hop culture : the best soil for the hop, is a calcareous loam, by which is meant a deep soil resting on limestone or a calcareous shale. It is necessary to provide for a vigorous start at the commencement of the season, for upon this depends the yield of hops, all things being equal. The field selected must have been devoted to other crops rather than the hop, for the ten preceding years. The field, if in turf, should be ploughed in autumn. In the spring it is to be supplied with rich barn-yard manure, and then ploughed again. Early in April layers or slips of the hop are planted in rows, six feet apart, in one way, and eight the other. The first year is a preparatory one, and a crop is not expected. To keep the field clean, and receive some return from it, corn is planted in the intermediate spaces, and the vines of the hop are suffered to run about the field, without trimming or poling. Early in the next season, however, the field is broken up with the cultivator : the hop cultivator requires teeth two inches longer than for corn. This finished, the next step is to set the poles. The instrument for making the holes is constructed like the common bar, except that it bulges considerably at the lower end, where, in the largest place, it is two inches in diameter. Two poles are required for each hill ; they are set eighteen inches apart, and should be fourteen to sixteen feet long. The hop comes up in numerous shoots, and when some of them are eighteen inches long, they require hoeing. In doing this two of the most thrifty vines are secured to each pole, by a woolen thread ; the others are allowed to grow a while, for the purpose of replacing one or both, if they should fail, or accident happen to

them. Subsequently these straggling vines are broken off, if they are not wanted; four only are allowed to grow. The hop will require to be hoed five times in the season, as it must be kept free from weeds, which in no case should be allowed to ripen in the field and scatter their seeds. The best wood for poles is white cedar, and should be two and a half or three inches in diameter: they cost from ten to twelve dollars per hundred.

The time for picking the hop is when the plant is in full blossom, as the aroma and medicinal properties of the hop are in full perfection at this time. To secure the crop in this condition is a great desideratum, hence many hands are required at this moment, or in this stage of growth. The work is usually performed by females; it requires neatness and dispatch, as no leaves or vines should be mixed with the hop. To secure these ends large wooden boxes are provided, with four arms and four equal compartments, into which the hop is thrown.

After the hop is picked, it is carried to the drying house, where it is subjected to a temperature sufficiently high for a rapid drying; the building should be two stories, the upper one for spreading the hops, the lower for furnaces; the furnaces are constructed like a large oven, and with a flue which opens upward, and spreading out like a large hopper, so that the hot air may communicate, by radiation, with the hops above. The floor should be covered with open netted cloth or hemp, with meshes one-twelfth of an inch in diameter; upon the meshes the hops are spread four or five inches thick The heat is attained from maple coal, which is used at the rate of one or two shovels full at a time, in each of the furnaces. One layer of hops is dried in twenty-four hours. The hops are then ready for packing in bags of cotton, forming bales like those used for cotton.

Another kind of labor in the field is yet required, viz. the preservation of the poles; these require to be stacked and bound up together in a standing position, else, if suffered to lie upon the ground, are speedily lost, or ruined. Hops have been sold in market for twenty-five cents per pound: of late they bring from seven to ten cents. Hops might be cultivated for an indefinite period upon the same ground, were it not for the larva of an insect, which finally infests the roots to such an extent that the plant is destroyed.

CULTURE OF THE TEASEL.

The Teasel (*Dipsacus*) is an important part of the apparatus for dressing cloth, and is so necessary that the work can not be performed properly without it, and it is a curious fact that no instrument has yet been invented which can supply its place. The adaptation of the teasel to the office to which it is put is due to the hooked termination of the chaff upon the teasel heads, which are bent outwards. The points of the hooks are exceeding fine, elastic and tough, but not rough; and hence their adaptation to the raising of a nap upon woolen cloth. The plant belongs to a great and natural family of plants, which have received the name of Compositæ, in systematic botany. The plant is biennial and bears frost well. It is not difficult to cultivate it, but the land must not be rich. The quality of the teasel is best upon the poorer stiffish clay soils. The ground is to be broken up in the spring; the seed is sown in drills,

three feet apart, and may be put into the ground any time between the first of April and the first of June: early sowing is the best. The young plant will require its first hoeing about the middle of May, or when the leaf is two inches long. In a few words, and omitting details, it is sufficient to say that the plant may be treated like Indian corn. The treatment of the teasel when grown, is thus: it is to be gathered when it is just out of blossom, or when the petal is ready to fall: this is the exact period when the curved awn of the chaff has the finest elasticity, and the crop must be gathered at once. At the time it is gathered the teasel head is full of sap, which requires to be evaporated; and this must be done in a way which shall prevent the least mouldiness or mildew. The drying is effected in a crib, like a corn crib, only the spaces are wider, as more air is required to circulate through it than for the drying of corn. Scaffoldings are placed across these, so as to form several tier of them, one above the other. They are placed about two feet apart; the pieces are laid across each other, in an open net-work. Here being exposed freely to currents of air the heads dry rapidly. An acre of land may yield, by proper attention, 75,000 heads: their price varies in market from eight to twelve shillings per 1000.

MADDER.

This plant, like the hop, requires a rich, mellow soil. The land must be underdrained, and trenches must be formed for carrying off superfluous water. The fields are laid out in beds, and it is planted so that the root may stand at equal distances from each, that the weeds may be more easily extirpated. The original color, madder red, may be changed into many shades by chemical agents.

Madder has the following composition:

Potassa,	20·30	18·07	
Soda,	11·04	7·91	
Lime,	24·00	19·84	
Magnesia,	2·60	2·50	
Peroxide of iron,	0·82	2·28	
Phosphoric acid,	3·62	3·13	
Sulphuric acid,	2·56	1·45	
Chlorine,	3·27	8·98	
Silex,	1·16	3·63	
Carbonic acid,	25·83	21·35	
Carbon,	4·13	11·48	Koechlin.

The essential elements which are required for madder, are potash, soda and lime. Stable manure is regarded as suitable to meet the wants of this plant. A true calcareous soil may be regarded as the best for the plant.

JERUSALEM ARTICHOKE.

The cultivation of this plant differs from any other. It is always grown upon the same piece of land, which is kept in good condition by manuring once in two years. They may be produced on a shallow, sandy soil : its cultivation adds much to the resources of the farmer. It is thought much of by Boussingault. In addition to the food furnished by the tubers, the stems furnish a kind of fodder for cattle. I may add that the sunflower also furnishes a nutritious food in its leaves and heads, when in seed or flower : the horse is remarkably fond of them, and eats the upper part of the stem with avidity. But I do not believe the sunflower can be cultivated with profit for feeding the horse, or any of our domestic animals.

SANFOIN,

Is fitted to a light soil, and is designed as one of the means of increasing the value of those soils which have suffered from long culture : it may be a gravelly, a sandy or light loamy soil. The land must be free from weeds, and especially from quack grass. It is sown with barley. The first season after the barley is taken off, it should not be fed : but it may be sown the next year, and fed by sheep until frost. The quality of the hay is such as to suit the horse. The value of this crop arises from the continuance of it for many successive years to furnish a good crop for the scythe, and after a tender feed for cattle and sheep. It is, however, unsuited to milch cows, as it imparts an unpleasant flavor to their milk. The roots of sanfoin are larger than clover, and penetrate deeper into the soil, and the sod is filled with roots.

When it is determined to break up the crop, it is ploughed, or the surface is cut with a breast plough ; only about one inch of sod is taken off—it is merely pared : when this is done it is left to dry ; it is then burned in heaps, and the abundance of ashes produced are spread over the surface, or used as they may be required. The field is now in a condition for turnips, or other root crops, or corn. There is still, after skinning off, a vast amount of organic matter in the soil, which will decay, and in combination with inorganic, furnish nutriment to a succession of crops. There is no doubt but sanfoin might be cultivated with advantage on the sandy soils of Albany county.

CELERY.

This fine vegetable requires care ; but it amply repays all the expense attendant on its cultivation, if properly bestowed. Celery may be sowed in May, in the open ground if designed for the winter. The seed is small, and germinates slowly. The plants are to be transferred, when they are an inch high, to a rich loamy bed, where they may stand till August, having been kept free from weeds in the mean time. During this month the trenches should be dug, about eighteen inches deep, and half filled with manure which is well rotted and in a pulverulent condition. This imparts a better flavor than the coarse unfermented manures. Mix the earth below the manure, intimately, with a fork. The plants may be trimmed, by the removal

of suckers about the crown, so as to leave the plant with its main stalks. Set the plants in the middle of the trench, in a single row, at the distance of six inches apart. Water the plants thoroughly. When they have attained a good size, earth them up, but prevent the dirt from getting between the stalks. Continue to earth up and water the plants, if the weather is dry, till November, when the plants will be large, fine, tender and crisp. If the fly attacks the plant remove all the injured leaves, and apply lime, by sprinkling it over them in the morning.

CULTIVATION OF TOBACCO.

The best of tobacco lands are those which are newly reclaimed from the forest. It is in these virgin soils that the alkalies, and particularly potash, exist, and which are capable of furnishing the requisite amount to impart the desirable properties, whatever they may be. It appears, in the case of tobacco, that it may obtain soda and lime, which become a substitute for potash; but its properties, in these substitutions, are quite inferior to the plant where it contains a certain amount of the latter: it is tobacco still, and perhaps it could not be distinguished, except by epicures; yet the fact is an important one to be borne in mind, that substitution may always give us inferior products, as in this particular case, and it is a fact which applies particularly to the coloring matters, which are more or less dependent upon the alkalies, one or the other, for some of their better and enduring characters. It is well known that most of the tobacco which has supplied this country has been raised in Maryland and Virginia, still tobacco of a good quality may be raised in the New-England States, New-York and Ohio. The expediency of cultivating it is another question, of which I have nothing to say. The tobacco of Connecticut is said to be better for segars than that of Virginia, and hence this branch of business has been entered upon with considerable spirit, in several towns upon the Connecticut river. It is, however, to be seen whether this crop is to prove a source of profit, ultimately. It is an expensive and exhausting crop for the soil to sustain; it takes at least from 170 to 200 pounds of mineral substances from an acre, and these are the most difficult and costly to be replaced, particularly potash.

Herting gives the following as the composition of Havana tobacco:

Salts of potash,	34·18
Salts of lime,	51·38
Phosphates,	9·04
Magnesia,	4·09

It is evident that a rich soil is demanded: it should be well mixed with vegetable or organic matter. In the case of tobacco, nothing is returned to the soil: wheat, oats and corn give back their straw, but tobacco goes to a distant market. For the cultivation of tobacco for segars, it appears from the experience of those engaged in the business, that the seed should be imported from Havana; that it should be renewed every two years, if the peculiar flavor of the Havana segar is to be preserved. Tobacco is first sown in beds, and afterwards transplanted to the field, which last operation should be performed before the first of August,

as otherwise the season will be too short for the plant to mature. The plant has two enemies, the tobacco fly and the tobacco worm. The former attacks the young plant, while in the bed; the latter after it is transplanted into the field: the former has been driven from the young plant by sprinkling them with ashes charged with fish-oil. Turkeys are sometimes allowed to ramble in the tobacco field, for the purpose of feeding upon the worm.

It appears that this crop is very liable to fail, from other causes than the fly and worm. If the weather is cold and dry in May and June the plants do not reach the size required for transplanting. There are, too, some contingencies attendant upon curing the tobacco, as drying, which must acquire a certain yellowness for market. The drying is performed in a building which is traversed interiorly by poles, upon which the leaves are suspended, and a fire is kindled below, or upon the hearth in the centre. In Connecticut, the drying is effected by currents of wind like the mode employed for drying the teasel: this is the safest mode. When fire is employed the temperature must be regulated with great exactitude, or the leaf will acquire an injurious tint.

PRODUCTION OF BUTTER AND CHEESE.

The dairying business differs essentially from the industrial pursuits, which have formed the subject of the foregoing pages. It is beset with more difficulties, as it involves complex questions relating to matters touching the animal economy. The soil, its condition, and the time when it should be broken, are questions which take the lead in the kinds of husbandry which occupy the mind of the farmer. In the business of the dairy, in addition to these, there are those relating to stock or cattle, in all their breeds or varieties; their feed; the effect of food upon their milk, etc.; and also, those questions which relate to the modes of making butter and cheese. I may, I think, safely say, that there are few, comparatively, good cheese and butter manufacturers; or those who are thoroughly acquainted with the principles of their business, or who conduct it acccording to rules upon which it is based, and not really upon certain empirical formula, which are blindly followed without knowing the reasons therefor.

The profits of the dairy are of course drawn mainly from the milk; this is the article first produced: this is subseqently converted into butter and cheese. What remains, after obtaining the concrete fat, termed butter, and the casein, called cheese when manufactured, is given to the swine for conversion into meat. The whole product of the cow, in this form, then, is turned to some account. There are several matters here, which may very properly come up for consideration. The great object is to increase the product of the cow, and preserve its qualities. The first subject will be but briefly stated. The animal should be milked at certain stated hours; it should be milked speedily; it should be milked clean, all of it should be obtained from the bag. If either of these points are neglected the milk will diminish in quantity; the animal will dry up. The milking can not be performed by any machinery, except the mouth of the calf or the human hand, let others think and say what they please. There is a peculiar influence exerted upon the lacteal system of the cow by the human hand, which pro-

motes the secretion of milk; a sympathetic influence proceeds from the act of milking, which is agreeable to the cow. So the milking must be performed at stated hours. When the hour arrives the udders are filled with milk, and the cow becomes impatient and wishes to submit herself to the milker, and if it is delayed half a day, although there will be no evident decrease at the first milking, yet it will be so at the next, and three days at least will elapse before the accustomed quantity will be restored. So if the milking is anticipated, it breaks up the habit, and the secretion is at once diminished for a short time. If the animal is imperfectly milked she at once begins to lose it. If, too, the milker stops to converse, or is called away after he has begun to milk, and afterwards resumes it, the cow will give considerably less. The general effect of these imperfections in milking is to induce a thickening of the cellular tissue, which supports or invests the individual milk glands, and gives fleshiness to the bag, which is shown, after all the milk is removed, by the slight diminution it has undergone in size. Perhaps it does not affect every cow alike in this peculiar way; but the loss of milk is sure to take place in all cows.

Milch cows should never be run or chased by dogs or boys, or in any way irritated. Probably there is no secretion which is so immediately affected as the milk, by any disturbances of this kind. It is not, perhaps, with the cow as with the female of the human being, who is giving suck, for here it is dangerous to nurse the child immediately after a paroxysm of anger, or a fright; but the physiology of the human being may be applied to the cow to a certain extent. It appears that very little attention is paid to these points: a gentleman has a fine flock of cows, and he employs a boy to drive them to and from pasture, and it is a remarkable boy who proceeds to his task as gently as he should do.

The next important consideration which affects the quantity and quality of the milk is the pasture. A hilly country is adapted to this kind of husbandry better than a flat or level one; the grass is shorter and of a better quality, and the water flows in a continued stream down their sides; there is, therefore, no injurious effect arising from stagnant water, in the vicinity of which poor grasses are produced. Again, in addition to a hilly country, it is a matter of moment that the water should be pure, which requires sandstones, or the primary, as gneiss, granite and mica slate should be the underlying rocks. These unite in themselves those conditions which are required to secure this end. The hard, slaty rocks—the primary and Taconic limestones, stand next in order, in favoring that kind of surface and that kind of water which promotes the dairying business. But the dairying business is also followed with profit in a level and flat country, where the water is hard, and where it is charged with alkaline and ferruginous matters: but after all, there is a difference in the qualities of the milk, and the butter and cheese produced. Compare, for illustration, the butter of Delaware county with that of Genesee and Monroe, and of a large portion of the State of Ohio, and I think that a judge will give a preference to the Delaware butter. In fact, Delaware is better adapted to this business than any other part of the State, and I do not forget that Orange county forms an important part of New-York; that Orange county butter takes a preference in market. I speak of adaptation, but at the same time I have proof in the quality of the butter produced in Delaware,

as a fact confirmatory of inferences which may be drawn from the character of the surface of the county, its water and its grasses.

But both butter and cheese may be spoilt in making; good milk is not all that is required; the production of either is a chemical process, which, when performed without sufficient knowledge of the character of the changes required, and of the circumstances which modify those changes, will be likely to end either in a diminished quantity, or possessed of qualities which will diminish their value. The state of the milk as to age, and as affected by the weather, or as affected by artificial temperature, always has considerable influence upon the results, and those who have determined, by exact experiment, the influence which these agents have, for good or bad, will manufacture the best butter or cheese. Even the rapidity of moving the churn-dasher, will affect the quality of butter. It is really surprising how much ingenuity and labor have been bestowed upon this simple machine, the churn. The infinite number, almost, of patterns and patents, and yet who can prove or demonstrate that among these numberless kinds there is one which is better than the old fashioned dash churn. Many seem to have adopted the opinion that the changes required for making butter are entirely chemical; that the agitation of the cream or milk is performed for the purpose of oxidation, whereas there is no such process taking place, so far as the fatty or oily matter of the milk is concerned. No doubt there are chemical changes; they follow from the agitation of the materials: but the globules of cream and the globules of butter are alike; no difference can be observed in them after the churning is finished from what they were before it began.

The mechanical movement which is adapted to the collection of the globules of fat, which when collected constitute butter, is a moderately rapid movement of the churn-dash, steadily and as equally moved as possible. If the dash is moved very quick and fitfully at first, the cream foams and swells, and the whole process is retarded; this is particularly the case in cold weather, when the cream has been frozen, and in this condition it is quite difficult to obtain the butter; the cream will remain a long time in a granulated state, apparently just on the point of forming butter. The steady application of the dash will then be required for one or two hours, and when the butter is collected and the process seems to be finished, the segregated granules of butter remain disseminated through the butter-milk. There is thereby a considerable loss of butter. Why the little segregated granules will not all cohere together in one mass it is difficult to say. The use of the dash, or agitation, is to bring about this result; it is merely a mechanical change, not a chemical one.

The temperature at which butter is most readily made is rather less than 60° Fah., between 55° and 60°. I have seen a total failure in producing butter by not attending to this fact, in the atmospheric churn, as it is called.

Another circumstance which should be attended to, is the acidity of the milk. When lactic acid is just beginning to form, the butter will be more perfectly separated from the casein, and that cheesey taste will be prevented, while at the same time the butter will keep sweet longer, or remain free from rancidity for a longer period. When the butter is collected it requires

working to free it from the butter-milk; the importance of doing this is well understood. A reference to the composition of milk, which I have given in the first volume, will show that sugar and casein are present in milk, and as butter-milk contains both, unless indeed the sugar is all consumed in forming lactic acid, etc. (which imparts the peculiar sourness to milk,) so, unless they are removed by working, rancidity will occur very early in the mass, and it will be impossible to preserve it in its original sweet condition. Those, then, are some of the conditions which should be attended to in making sweet butter.

I have omitted a very important matter, the salt which is to be employed for this purpose. It is necessary that salt should be free from impurities. Let any one take a few quarts of the common Turks-island salt, and wash it with water, it will discolor the water and become quite dirty, and at the same time it may have acquired a bitterish taste, from the chloride of magnesia and other bitter salts, which are frequently present. By washing the salt in a small quantity of water, and giving the remainder an opportunity to dry in a thin suspended bag, is an admirable mode of obtaining good salt from most of the kinds in market.

The milk which is best for butter making, and indeed for cheese also, is that which is milked last from the cow. This is very well understood by our milk-men, who furnish families in cities. Their practice is to put all the first milkings into their cans for sale, and keep the last for themselves, for making butter. They are sometimes, perhaps, on this account, charged with watering their milk. It is possible there are instances where both practices are common. Another mode of increasing the quantity of milk is to feed the animals on brewer's grains. Instances are common, where this feeding is carried to a considerable extent, where the cow becomes diseased or lame and feverish: this watery milk is one of the results. It is too bad to water, still farther, milk of this kind: and yet it may be said, perhaps, the less we get of it, and the more water it contains, the better for our health. The richness of milk depends upon the quantity of butter which can be made from it; thus, a cow which yields milk, nine quarts of which will make one pound of butter, has a richer milk than one which requires twelve quarts to make the same amount. It is not the casein, then, which imparts the desirable quality to milk, but the oils, or fatty matter. The milk which is intended for cheese may be less rich, or the cows may be pastured on poorer land, and where they will be obliged to take more exercise in procuring their food. Most of the cheese of this country has been made by guess, and yet there are many excellent dairies, and much good cheese made.

To make good cheese certain preliminary points should be attended to. 1. Keep none but quiet cows, and those which are milked easily. 2. The milk should be received into sweet, dry pails, and strained as soon as possible after milking. A strainer should be fixed upon a ladder laid across the tub into which the milk may flow as it passes through the strainer, which should also be perfectly free from sourness and all impurities. In small dairies where only one cheese is made daily, the milk usually stands over night, and is skimmed in the morning: the morning's milk is afterwards added. The milk should now be set for the cheese. The first step to be taken is to raise the temperature of the milk to 85° Fah.; if it is raised to 90° it may be too hard. If it is to be transported to a distance, it is safer to raise to 88° and per-

haps 90°. In June, July and August, when the morning's milk is strained immediately into the evening's milk, the temperature will be nearly that required; but usually, from ten to twenty quarts must be warmed over coals, and in a water bath, sufficiently to raise the temperature to the right point. The proper temperature may be determined by calculation, on the principle that if the milk be divided into two equal parts, and one heated, the mixture will give the mean of the two. Ninety-eight degrees is blood heat, or that of the human hand, hence when plunged in a liquid of 85° it feels cold, because colder than the system, or the organ immersed. If a kettle is used over the fire, it should not blaze, lest the sides of the kettle burn the milk, or impart a bad taste to it. After the right temperature is obtained, the next step is to add the rennet. The method of preparing the rennet for this purpose, in a good dairying district, is this: saturate two gallons of boiling water with good salt; let it stand, cool and settle, and then pour off the clear liquid, and infuse in it two rennets, for two or three weeks, when it is fit for use. Of this liquid two table spoonfuls will coagulate, or bring, as the expression is, thirty-five pounds of curd. It should be well incorporated with the milk, by stirring quickly, that it may act upon the whole milk at once. It should then remain still and undisturbed, until the curd has acquired sufficient consistence to be cut; when a knife will pass through it with sensible resistance, and leaves the curd distinctly divided, and shows a rippling of whey along the line of the cut. It is cut into two and two and a half inch squares. When this is done it must stand till the whey separates from the curd and it has grown firm, so that the mass can be lifted without breaking. A strainer is then pressed down upon the curd and the whey is removed, a pan full of which may be warmed up to 98° or 100°, which may then be poured over the whole curd. The curd will harden by this course, and become brittle. The whey may now be dipped out or drained off, and the curd broken up by the hands and salted; a tea-cup full of salt to every fifteen pounds of curd, or to be more exact, one pound of salt to sixty pounds of cheese after it is cured; this is the Herkimer county rule. In Gloucester, England, the salt is put upon the outside of the cheese, at the rate of three and a half pounds to every hundred pounds of cheese. In American dairies the curd is always broken fine in the hands, after the greater part of the whey is dipped out, but care should be taken not to squeeze the curd, as the cream, or richer part, will be lost in the whey. When broken fine it is placed upon the strainer where the whey may drain out; it is then gathered up in it and secured in the hoop for pressing, which should be applied moderately at first, and evenly as possible. The time it should remain in the press depends upon the size; a cheese which weighs thirty-five pounds should remain two days, if sixty pounds, three days, if one hundred pounds four, or even five days. A cheese requires turning twice a day, morning and evening, at which time the cloth should be renewed. In removing the cloth, care should be taken not to break the surface of the cheese. When the cheese is pressed it still requires turning upon the shelf, and rubbed over daily with melted butter, in which a small quantity of annatto has been dissolved. Large cheeses require a cotton binder. The cheese room should have a temperature of 55° or 60° of Fah. It is scarcely necessary to add that perfect cleanliness should be observed. It should also be dark. When the curd has been scalded too much

the cheese does not press well; the whey being retained, it oozes out through holes or cracks, into which the fly will deposit its eggs, and hence leaky cheeses are infested with maggots; these, when found should be cut out, and the place filled with a mixture of lime and butter or tallow, and covered with cloth. Hot weather demands and requires the closest attention to the cheese and cheese room.

The secret of making rich cheese lies in the preservation of the cream in the curd, for the cream of the milk is not coagulated by the rennet, and hence it is liable to be forced out in breaking up the curd; the whey should be observed, to learn whether the cream is lost or not; if found upon the whey it should be skimmed off, and used for dressing the cheese. The practice of skimming the night's milk in the morning is right, as it would be lost if left in the milk. Neither would it be of any use to add cream. It is estimated that milk which will make one pound of butter will make two pounds of cheese, hence it takes six or seven pounds of milk to make a pound of cheese.

CHAPTER XIII.

ON THE FOOD OF ANIMALS.

GENERAL CONSIDERATIONS.

It is scarcely necessary to remind the reader that a constant supply of aliment is demanded by all living beings, from the earliest stage of development, from the germ-cell to that point in existence where the vital forces quit the fabric. The materials which are subservient to the development of a new being are derived, in the first instance, from the parent; the higher types of organization are strongly contrasted, however, with the lower, in both the animal and vegetable kingdoms. In the mammalia the new being has its parental connection continued for a long period, comparatively, during which it undergoes a variety of changes, all of which carry it upward to the form and semblance of the parent, so that, at birth, or when it is detached from the parent, it has acquired all the distinguishing attributes which belong to it as a species, so far at least as its physical organization is concerned. It has undergone its series of metamorphoses, and now, to complete its development, it has merely to acquire an increase of size. On the contrary, those animals and plants which rank low in the scale of organization, have but a brief parental connection; they are cast out upon the world and thrown upon their own resources at an early day, and although these are sufficient, ordinarily, to secure the preservation and development of the individual, yet, as nature is solicitous for the preservation of the races, she secures this by multiplying to excess, as it were, their germs. The great class of invertebrate animals cast their ova profusely upon the theatre upon which they are to move; and, as if to secure still more perfectly their continuance, they often multiply by buds and by division. The cryptogamia, as in the case of the puff-ball, send forth millions of spores, or of germ-cells, which are capable of developing an individual like the parent, whenever they rest upon a spot suited to their natures; but millions must perish for want of a suitable spot and medium, upon and in which to exercise their latent functions.

In the higher vegetables, the germ-cell is surrounded by a store of nutriment, in which all the elements are concentrated which are essential to the first stage of development, or until it can strike its radicles into the soil, from which, in the future, it is to draw its entire supply. Fixed

to one spot, so far as its rising axis or stem is concerned, its range for supply seems, at first view, extremely limited. As a substitute, however, for the powers of locomotion, its radicles penetrate deeply and widely in search of food, and extend their bounds annually, if its existence is prolonged. The requirements of different plants are various: some require carbonic acid and water only, as those which are composed of cellular tissue, or rather cellulose; scarcely any exist, however, which are so simple. The boletus and lichen upon our rocks and trees contain inorganic matters, and in many there is a free supply of ammonia, as is shown when they decay.

All the higher animals possess a complex structure, and contain a great variety of elements in combination. To supply these in proper proportions, and adapt them to their periods of growth, to sustain the mature animal and supply its wants, so as to advance our own interests in it, and make it yield to us the greatest service or benefit, is the main object which man has in keeping the domesticated animals. To accomplish this end requires an intimate acquaintance with the various kinds of food, and with the physiology or nature of the animal, and of the performance of those functions which administer to its full development and growth. There are still other points to be determined, where the animal furnishes from its system products useful and necessary in civilized life, as milk and wool: hence we wish to know what influence food has upon those products; how their quality and quantity is affected by the agencies to which they are exposed. The effects of cold and heat, dryness and moisture, have each their influence upon the animal system. Exercise and rest have also their share in modiyfying the products of organization. To these it is necessary to add a kind disposition, and an aptitude to acquire or be taught, along with which it is evident gentleness must have a place: so an attachment to place, and a dislike to wander, are important points in all animals. In illustration of the foregoing statements, let me inquire, who does not know that it is difficult to improve the condition of restless animals, or any animal, by giving it food which contains neither fat, oil, amilaceous or saccharine matters; or who would feed an animal upon these alone, who wished to give muscle and bone their due proportions. It is but a truism to assert, that we can not get from a body an element which is not in it. Inorganic matter can not be obtained from any of the numerous compounds of carbon, hydrogen, oxygen and nitrogen. The constant demand for food is an important fact to be considered in the economy of animals; this is true when they cease to grow, and it is also true that they ingest a greater quantity than the system appropriates. The constant want of aliments arises from molecular changes in all parts of the system, by which a constant waste of tissues takes place, and from which it follows that an opposite molecular change must also take place, to carry new molecules to the places occupied by the effete and worn out ones, which are destined to be cast out of the system. But waste does not go on uniformly in the tissues; it is greatly modified by external and internal causes; it differs in different animals; it is rapid in proportion to the temperature and rapidity of the circulation. In birds, muscular waste is rapid; in carnivora, it is less rapid; but in reptiles it is slow, and by this we account for the long periods during which they can fast, and also for the ability of some of the mammalia to pass a winter without food, or tempo-

rarily take the place of reptiles, in the reduction of temperature, and abstain from all aliments during the greater part of the winter months. The waste and disintegration of the animal system goes on under all circumstances, but not equally; it is apparently rapid in a severe disease, as is evident in many cases, as the emaciation is excessive, even though of a short contiuance.

One of the most striking effects of waste is the fall of the leaf in autumn: it may, at least, be regarded as a modified result of decay, and is to the vegetable what the constant waste is to the animal; it is a periodical waste, while in animals it is constant. Vegetables are not, then, strictly speaking, exceptions to the law of waste and loss of certain tissues, but the whole loss is sustained at once, though this is modified by climate. The systems which are subjected to the greatest waste are the muscular and nervous systems in animals, and the exhalent system in vegetables; and it is to supply them with renovating matter, that food is required at such short intervals in the former class of beings. Exercise rapidly deteriorates the muscular energy and the integrity of muscular fibre. Mental exercise wastes the nervous matter, and temporarily weakens the intellectual force. Decay is a consequent of activity. The capillaries are active, both in removing and destroying, and thus life internal, like the outward life, is but a contest, a struggle between opposing forces. When the forces are balanced the man is in his vigor. When the renovating force exceeds the disorganizing, growth is the result—it is the child stretching its arms to manhood; when the latter is predominant, the climax of strength and vigor is past, and age is marked upon the subject by emaciation, leanness of visage and a tottering step. The muscular system labors to maintain its elasticity, the upright form and noble carriage: but the nerves, the messengers of the will, faintly respond to its mandates, and transmit them but feebly and cautiously, as if fearful the dilapidated frame would sink under a vigorous effort. In these last stages, that most striking result is the absence of the combustible material; the fatty combustion has more than kept pace with the supply of fuel. The oxidation of the solids, or their combustion, is one of the greatest sources of waste. A large stock of materials is required for the sole purpose of maintaining the temperature of the higher grades of animals above the surrounding medium. Let the aliment for the oxygen become consumed and it attacks the solids of a higher grade, at the expense of finally sacrificing the fabric, so essential is it that the heat should be kept up. It is like the fire of a dwelling, when it has consumed its proper fuel, seizes upon timbers, and wastes the strength of its frame-work, till it falls under its own weight.

Another fact is well established, and this, too, has an important application to the feeding of domestic animals, viz., that food is required to meet an excessive drain upon the system, as the suppuration of a large abscess, or the secretion of a fluid, as milk. The supply of milk required to sustain the young exhausts the parent, who requires, in her turn, to receive a larger allowance to meet these larger demands upon her system. The system manifests its want of nutriment through the stomach, and the exhaustion of the fluid parts by the fauces. Hunger and thirst are sensations indicative of their respective wants, and their calls are too urgent, often, to be disregarded. The powers of life wane more rapidly than they wax, if the individual disregards their calls. The frame is exhausted in a day, but can not recover in three. The

cow fed upon food deficient in nourishment will manifest its effects in the diminished quantity of milk, and will not recover the normal condition for two days: the nature of milk and the character of the life-force explain this. The life-force of the system must be restored first, and its expenditure, which has not been met with its wonted supply, monopolizes the first aliment which is furnished, and when the general system has recovered its normal state, and not till then, will it give up its nutriment to the special functions which play but a secondary part in the living system, in importance to the welfare of the whole.

THE FEEDING OF STOCK.

Domestic animals are maintained for four purposes: 1. For furnishing a nutritious aliment, as milk. 2. Clothing. 3. For their labor or service. 4. For their flesh. These four purposes might be resolved into one, the last I have named, for really it is their flesh, or its products that we obtain, whether it is in the form of meat, wool or labor. The great end to be answered, then, in keeping them will be fulfilled by furnishing them with that diet which is the most easily changed into flesh. What is flesh? Flesh is organized blood, and blood is water, albumen, fibrin, iron and various salts, in combination, all of which may be derived from the vegetable kingdom, as from peas, Indian corn, and other cereals.

The inquiry which interests the farmer, in regard to his stock, relates to the mode and manner of feeding them, and what will secure to him the ends which he has in view in keeping his cattle; what food will give him the best milk, or what is the best food for fattening them; or, in case of working oxen, what food will give him the most profit while employed in labor. The cow, under no circumstances, is inclined to take much exercise; there is, therefore, a less amount of the tissues consumed than there would be provided she was driven to work or compelled to take vigorous exercise. Quietude and rest favor the secretion of milk, and hence, in providing for the milch cow, regard must be had to the respiratory wants, which may be supplied by the starchy and saccharine compounds, and then for the wants of the system, which is to meet the albuminous matters, and finally to the milk, which is albuminous, fatty and saccharine, and which may be supplied by the same matters which supply the waste of the system. Milk contains all the elements necessary for the growth of the young animal, and so in the waste of the system, the muscular, nervous and osseous systems, the elements which are removed will be identical with those contained in milk. If an animal required only a provision for the respiration, sugar, gum, starch, or the amilaceous bodies, would be sufficient. Those, however, never form parts of organs, hence if fed only upon such bodies, the organs, which are undergoing continual change and waste, would be left entirely to a consumptive process, and destitute of the means of renovation: the system would perish under the regimen. In the means which are provided in the system of nature for the sustenance of animals, she has combined the necessary elements of respiration and nutrition, in most of the bodies designed for the food of animals. We are not obliged, therefore, to look about and prepare special aliments to meet the varied wants of animals, or rather to manufacture them. The following, however,

is true: there are substances already prepared which have special adaptations, and we may select from them what we deem suitable to meet the ends we have in view. There are, for example, bodies which promote the secretion, and increase the quantity of milk, and some which, if they do not increase the quantity, may improve its quality. Grass and hay contain all the constituents of flesh, milk and matters for respiration: we find albumen, wax, sugar, extract and gummy matters, in combination with the inorganic bodies, lime, magnesia, phosphoric acid, potash and soda. By reference to the composition of milk, and the grasses, it will be seen that the latter are well adapted to the formation of the former, that is, they contain the elements necessary to that end. In feeding a cow for milk, we should proceed in the same way, and use the same material, that is suited to a growing animal; it should contain matter which would more than supply the wants of the system, and which may be spared from the system. Of these substances, bean meal, oat and corn meal, or a mixture of oats and corn, are found, experimentally, to serve the purpose designed. In these, the nutritive elements bear to calorifient the proportions of one to two and a half, and one to five. The albuminous or nutritive will supply not only the waste of the system, but also furnish enough for growth or milk. Some farmers allow their two year old heifers to come in at this early stage, and before they have attained their growth: it would seem to be a questionable policy, for, all things being equal, we can not but see that under those circumstances the animal will not attain her full size and proportions. The bony system is not consolidated, the body is small, and if, while growing, she also is required to furnish milk, the system will fail to receive the amount of aliment to meet all the demands upon it. There is probably an advantage to bring them in at this age, for the ostensible reason that the lacteal system will be more perfectly developed; it will at least reach its maturity at an earlier day. But when we consider what is required by a growing animal, the objections to this course have considerable weight: the remark is made on the ground that the animal is immature. The same objection lies to the hard work which horses, I should say colts, are put at an early day, before they are mature, and before they have attained their growth. The waste of the system, when put to hard work, is equivalent to the production of milk, in the case of the heifer. The body fails to be nourished, and hence can not grow. Some breeds of horses and horned cattle attain an earlier maturity than others. If cattle mature early do they last as long as those which mature later? In regard to early use of animals, it is determined upon an extra allowance of food, sufficient to meet all the wants and requirements of the system. In the early period of life the more substantial food is required, yet it has to be given with caution. There is nothing more reasonable, in this kind of husbandry, than that food should be given in kind, and in such quantity, as to supply the waste, and the waste is great in proportion to the exercise and labor put upon them, or to the amount of work they are required to perform. The expenditure of calorifient matter is also much greater under labor and exercise than at rest, and much greater in cold weather than in hot. A ration which would be amply sufficient, when at rest, would be a short allowance if expended in labor, or one which would surfeit in summer would be dissatisfying in winter.

In winter cows do not yield as much milk as in summer, because a larger portion of their food is consumed in keeping them warm. If stables were fitted up in some mode by which the temperature of their bodies would be maintained by artificial heat, their milk would be increased, and their food diminished. It is impossible for them to consume hay enough in winter to preserve their temperature, and have aliment to spare for milk, when exposed in the open field, or even open sheds. It is well known that nutriment in itself is not all that is required in feeding the domestic animals; it must possess bulk. The stimulus of distension is required to favor digestion; and all, or almost all the bulky kinds of food, as hay, contain calorifient matter in large proportions. By this proportion, in obtaining bulk and distension, the stomach is less loaded down by a heavy diet. We give two or three quarts of provender to a horse, or cow at one feeding, and supply the stomach with fifteen pounds of hay: but to distend the stomach to that amount with meal would be perfectly destructive; the nutrient matter would be in great excess. If we take milk as the proper standard for the food of growing animals, we find that the proportion of calorifient to nutritive matter, is as one to two. This standard may be often referred to in feeding adult animals, provided we regard the working animal as requiring food in proportions equivalent to those of the growing animal. When at rest, the proportions will be as one to six or five, instead of one to two. Work, or exercise, consume flesh and nerve, and hence the nutritive elements must be increased. At rest the animal consumes the carbonaceous bodies, as starch, sugar, gum, oil and wax. Agreeable to theory, those compounds are suitable for a winter diet, inasmuch as they are rich in calorifient matters, when the animal is at rest; if worked, an increase of nutrient substances is required.

The principles contained in the foregoing remarks point out the necessity of protection and warmth for our domestic animals in this climate. Shelter from storms is equivalent to food. A good barn is interest money, in stock or cattle, payable in May, at the rate of ten per cent on all investments of this kind. The estimate is probably too low if we take into account the profits of animals which have been sheltered, over those which have buffeted, unprotected, the north-westers of this climate. There is another point of considerable importance to those who rear young stock: it is a desideratum to promote their growth in winter. Usually farmers are satisfied, if their young stock survive the winter, and appear in the spring in a tolerable condition. At best, young cattle are stationary during the winter, or their increase may be perceptible, yet it is not half what it should be, and might be by good shelter and the same amount of food.

There is a peculiar condition which may be witnessed in ill fed animals, which is analogous to what occurs in some penitentiaries, where the inmates are put upon a starving allowance. It is this, the system is reduced to a point, by poor food and little of that, that the organs of digestion can not, or will not digest even the pittance of food allowed. The appetite is gone, and the food does not digest so perfectly as when more is allowed. It sustains and prolongs the life, but the system is debilitated, and the nervous system is the greatest sufferer. In man, want of food creates listlessness and indifference, and may even induce insanity. In domestic animals the system is enervated, but the nature of the case does not discover itself to us. The

important fact which I wish to convey, is, that a certain amount of food, and which contains so much nutriment, is essential to the process of digestion; poor food, given in small quantities, disables the digestive organs and destroys the appetite, and though the animal may survive, its value is greatly diminished. Young animals require frequent feeding: the digestion is more rapid, the circulation is more rapid than in adult animals. The waste of the system is in proportion to the rapidity of the circulation, hence the more frequent supply of aliment is called for. Very few pay attention to this fact during the winter, when animals are fed. There is still another point which should be considered, in the case of young animals; it applies more particularly to the first days or weeks after birth: it is this, the young are unable to generate warmth or animal heat. If exposed, their animal heat falls rapidly, and they perish sooner, from this cause, than animals which are older. Protection from cold is an urgent measure, then, on account of the danger to which it subjects the young. Though the young require a frequent renewal of food, it is only in small quantities that it is required. We are to imitate, in this respect, the operation of instinct, which guides the parents in supplying food to their offspring. In young animals the food which is required must contain phosphates. Phosphate of lime must be contained in the food of all young animals. The bones at this period are not fully ossified, and those matters which can supply this mineral substance is demanded. Corn meal is as rich as any form of food, and the cheapest aliment which can be given. I would not advise a mixture of ground bones, because I doubt of their being digested. The cereals all contain the necessary amount, in the condition best suited to the wants of a young animal. The special aliments which are adapted to young animals, as calves for market, where fat is an advantage, is linseed meal with milk; and so also, corn meal, or a mixture of corn and oat meal in milk whey. In feeding both the young and adult animals, for market, it is important that food containing oil should be intermixed with the amilaceous ones, in order that the animal may derive the full benefit of both classes of bodies. In order that the oil of Indian corn, for example, may be digested, and administer to the fat of the body, it must be given with the starch. It is true that animal oils, as cod liver oil, fattens the emaciated subject in the most remarkable manner; but after all, it may do this by being assimilated with amilaceous substances contained in the ordinary food. A mixture, then, of the oleaginous with the amilaceous, seems to be adapted to the fattening of domestic animals, and the good effects of those mixtures are confirmed by experience. Weak aliments, or those whose solids are in combination with much water, as turnips and potatoes, cut hay and straw, are required to fill the digestive organs, to create distension, without which the animal will not digest its food, especially that which is concentrated. Linseed boiled in water, and which forms a jelly, has been employed in fattening animals, with the best results.

To promote fattening, confinement is resorted to, although exercise is required by all animals for the sake of perfect health: at the same time speedy fattening makes the best meat. An animal which has been in the fattening process for a year, or eighteen months, has meat which is less tender than if only three months had been consumed in the process. Exercise increases the waste, and requires more food. The true system seems to be to steer a middle course;

abstaining from close confinement and giving air and exercise, moderately in the yard or limited enclosures, and feed with a variety of elements. Frequent changes of food favor the appetite, or preserve it, and gives the organs power to digest a larger quantity, and put on more fat in a given time than if confined to one kind of food. Probably the dietetic rules adapted to the wants of man will apply to the domestic animals; variety in his case is conceded: when variety is forbidden, as in our penitentiaries, the health suffers. We may see, especially, some of the effects of this confinement, in the fatal effects of epidemics, when they visit establishments of this kind: the mortality is much greater than in other places. The confinement of animals in dark stalls is objectionable, on the score that light is essential to full health. Animals, however, consume less food, and fatten more, when light is excluded for a time, than when exposed to light. But the exclusion of light is inadmissible only for short periods: more disease, ill health and liability to epidemical disorders exist in narrow lanes of cities, and the darkened sides of dwellings, than those which enjoy the full and cheerful light of day. Much is known of the influence of physical agents on man, but little knowledge has been acquired of the influence of these agents on animals. Enough is known, however, to satisfy an intelligent man that close confinement is prejudicial to good health, and of course to the production of healthy fluids.

General summary of some of the foregoing principles relative to the feeding of stock.

1. Food contains two classes of bodies, the calorifient and the nutrient: to the former belong sugar, starch, gum, wax, and amilaceous bodies in general; to the latter, albumen, fibrin, or albuminous bodies, and all those which are deposited in the tissues.
2. The calorifient bodies contain carbon, hydrogen and oxygen; the latter, carbon, hydrogen, oxygen, and nitrogen, besides which are found sulphur, phosphorus, iron, lime, magnesia and the alkalies.
3. The calorifient, as their name implies, are expended in keeping the system warm; or, in other words, are burnt, and pass off in the form of carbonic acid, while the nutrient are formed into membranes, muscles, nerves and bones.
4. The living system undergoes continual changes, as waste and decay, which is in proportion to the natural temperature of the system, and the exercise and action it is subjected to.
5. The young waste more rapidly than the old; they also restore the wasted materials more rapidly, or when the forces are more energetic.
6. Notwithstanding this fact, the young are incapable of generating heat in their bodies, to the extent which the adult being generates, and hence it always requires aid in keeping up the required temperature, as the body of the mother, the application of wool, cotton, or culinary heat. And hence, animals who are kept for breeding should rarely be left to wander from those who are their protectors, especially in seasons when they would be subjected to malign influences.

7. The proportion of calorifient matter to nutrient, should be greater for young and growing animals than for adults; and also where the adult is subjected to labor, it will require the same proportion, in order to supply the waste of the muscular and nervous tissues, as they require for their growth.
8. Food should be given at proper intervals to those who labor, and it should be proportioned to the amount of labor performed. Persons who exercise their minds are not exempt from the law of decay: the waste of nervous matter is more exhausting than the muscular.
9. Nature has combined, in many instances, the true proportions of calorifient and nutrient matters, as in the cereals, and in milk. We may, however, modify ourselves the proportions.
10. The winter food should be adapted to the rigors of the climate, and adjusted also to the amount of labor to be performed.
11. Protection in winter is equivalent to a saving of a certain amount of hay or grain; and he who neglects to provide warm stables, or warm shelter, wastes both hay and grain. The observation of the last precepts is enforced also by the principles of humanity. A beast that is left to shiver in the cold is far more dangerous than one that is protected; and it is more likely to injure the weak of the flock and is less docile, and if a milch cow, is far more troublesome with her legs. There is, really, no substantial reason which can be urged in favor of feeding cattle in an open lot, at a stack of hay. It has been urged on the score of making hardy animals; but the principle upon which the doctrine is supported has no existence: we might as well starve an animal for the purpose of giving it a power to live without food.

CHAPTER XIV.

CULTIVATION OF FRUIT TREES AND FRUITS.

This elegant, as well as important department of husbandry, has engaged but a few intelligent men, compared with the great mass who have successfully pursued the cultivation of grains and grasses, and the raising of stock. An impulse, however, has been given to the rearing of fruit trees within the last ten years. Formerly it appeared that the great object of an orchard was to furnish a beverage for common or every day consumption, and for the production of brandy, for harvesting and other important occasions. The temperance reformation, however, laid the axe at the root of thousands of apple trees, in New-England and New-York. The orchards, however, were mostly those which produced an inferior natural fruit; and hence, is not so much to be regretted; yet, the interest in fruit culture, of all kinds, was greatly diminished, and the business was at a stand still for many years. It is now discovered that fruit can be applied to more purposes than one, and that the business recommends itself on the score of profit, as well as pleasure. The former inducement, however, is the only one which can operate upon the majority of farmers.

It is not my design to go minutely into a description of the mode of rearing trees, and of the special management of the different species of fruit. I shall only recur to a few of the general principles which lie at the foundation of this kind of business.

1. *Setting Trees.* The common faults, with most persons, in setting trees, are, that in removing them from the nursery they injure the roots, by bruising, breaking and destroying a very large proportion of the fine roots, with their spongioles, or their fimbriated extremities. If they live, or survive their transplantation, they require a year to recover from the injuries they have received.

2. When taken up, all roots should be moistened sufficiently to receive a coating of clay or stiff loam, which will serve to protect the tender fibrils, and give the power of transportation, or of enduring the drying effects of winds, to which they must be more or less exposed, before they can be reset.

3. When about to be planted, moisten again the roots, and sprinkle dirt on them, placing them carefully in the hole prepared for them, which should be large to receive considerable

aliment well mixed with the dirt which is to be replaced. Spread out the roots in the natural manner, and carefully fill up the interstices and pack down the filling closely. In the hole it is better to drive a stake, to which the tree may be fixed. A great many trees are lost by the wind, which loosens the roots and prevents their fixation in the soil.

4. If the trees have been above the surface sufficiently long to dry the bark, bury them, root and branch, in a moist soil, until the bark is softened.

5. Trim the top, to meet the necessities of the root; and to aid the root in its functions, keep the trunk and limbs moist, rather than drench the root with water.

6. Trees which are expected to thrive, must be supplied with nutriment: they are often badly furnished. Spading the ground and spreading manure freely once in two years, will be repaid in a greater and better return of fruit.

7. Large trees may be transplanted by cutting a trench at a distance from the trunk, through the roots, the season before it is removed. The earth around the undisturbed part will be filled with rootlets sufficient to sustain any tree which can be handled by a company of men.

8. The bark should not be broken; limbs and roots which are injured should be amputated.

9. Trees are supposed to be destitute of the power of locomotion. This is true only of the trunk, and instead of a movement in body, the mouths, which suck up nourishment, travel. Instead, then, of applying food around the base of the trunk, it should be applied at a distance.

10. When a shrub or tree is too much inclined to produce leaves and branches, and refuses to bear fruit, cut with a spade the most distant roots; or as the operation may be termed, foreshorten the roots.

11. Most fruit trees should have their branches and tops foreshortened. The axe and saw are used too freely upon a large proportion of our apple trees; especially in cutting the large lower limbs. The tree is injured thereby, and besides it shoots up beyond the reach of the ordinary means employed in gathering its fruit. The soil best suited to the production of good fruit is a good soil, and most of the kinds require a strong soil. Of the cultivated fruits, a dry soil, too, is generally indispensable: the apple, pear, peach and plum require a dry soil, without exception. The quince grows the best in a rich, moist soil, where the suds from the kitchen may water their roots.

The reader will find ample details in relation to the composition of the inorganic part of fruit and forest trees, in the second volume, and also the mode and manner in which it is distributed through the vegetable system. The fruits were omitted in these general researches respecting the composition of the ash. I commenced the work of analysis of apples and pears in 1847, but did not proceed far in the work, in consequence of ill health. I subjoin only a portion of the results I obtained at this time. They are sufficient to show that in the removal of apples and pears, considerable expensive matter is also taken away, and hence there will necessarily follow the exhaustion of the soil, a fact which had escaped the attention of pomologists.

PROPORTIONS.

Flesh of the Pomfret Russet, an apple which may be preserved three years: 100 grains contain,

Water,	90·48
Ash,	0·49

Skin,

Water,	78·26
Ash,	0·51

I had supposed that the keeping qualities of this apple were due to the inorganic matters of the rind. It is, however, a doubtful question, which it is difficult to solve. It will be observed that the alkalies abound in the pulp of the apple and pear; that the proportion of ash is small, but that it is rich in potash, soda, phosphoric and sulphuric acids. These facts have an important bearing on the treatment of fruit trees. It is evident they require more potash and soda than they have yet received.

Composition of the ash of the Esopus Spitzenburgh:

Silex,	2·201
Phosphates of lime magnesia and iron,	14·573
Lime,	1·193
Magnesia,	0·212
Potash,	32·897
Soda,	17·753
Chlorine,	2·600
Sulphuric acid,	7·261
Carbonic acid,	16·221
Coal and organic matter,	5·130
	100·041

Composition of the St. Germain Pear, or as it is named in the Albany market, Winter Bell or French Bell Pear:

Silex,	3·312
Phosphate of lime, etc.	18·072
Lime,	0·242
Magnesia,	0·130
Potash,	38·512
Soda,	5·932
Sulphuric acid,	9·875
Carbonic acid,	18·012
Chlorine,	0·400
Organic matter and coal,	5·230
	99·717

In supplying fruit trees with manure, it is very possible that there is less difference in qualities of the solid excrements than has been supposed. Their qualities will evidently depend upon the nature of the food of the animal, the solid excrements consisting mainly of the undigested portions. Thus, the cow and horse being fed exclusively upon hay, their solid excrements will consist mostly of hay undigested. The following analyses will show the differences:

	Excrements of the horse.	Cow.
Silex,	67·000	63·000
Phosphate of lime and magnesia,	9·600	21·400
Carbonate of lime,	3·500	1·200
Magnesia,	1·000	0·100
Potash,	6·300	3·650
Soda,	5·400	3·200
Sulphuric acid,	5·410	6·261
Chlorine,	0·400	0·080
Organic matter,	0·100	0·120
	98·710	99·011

The manure was made exclusively from hay, and also from the same hay; and it will be observed that there is a similarity in the composition of the two, particularly in the amount of silex, which is quite large, and which shows that silex is scarcely, if at all, assimilated, the amount in each case being nearly the same that would be obtained in the analysis of hay. The amount of alkalies is quite small in the excrement from the cow, when fed upon hay. They are richer in phosphates than that derived from the horse. The hay consisted of timothy, and was cut, as it appeared, when fully ripe. An idea of the value of a particular manure may be formed when it is known what the animal ate. For grass those manures are particularly valuable, as the silica will remain mostly in a soluble state, and ready to enter into the tissues of the plant again.

It will be obsererved that the foregoing fertilizers are not sufficiently rich in potash to be well adapted to the production of fruit, while in sulphuric acid they will answer a good purpose. Ashes, applied once in two years around the roots of trees, will supply the deficit better, probably, than any other fertilizer. It is highly probable that the cause of defective fruit will be found in the absence of potash, and the phosphates of lime, potash and soda.

CHAPTER XV.

ON THE MILK OF THE COW AND THE SOLID EXCREMENTITIOUS MATTER, AS AFFECTED BY FOOD AND TEMPERATURE, OR THE SEASON.

THE experiments which I am about to give, in detail, were undertaken for the purpose of ascertaining the influence of food on the quantity and quality of the milk of the cow, especially upon the quantity of butter which the winter's milk contains. In undertaking this task, I am aware that cows differ materially among themselves, both as it regards the quantity and quality of their milk. It has not, however, been so well established that the winter milk differs from that of summer, which I believe I am justified in stating. I was the more desirous of undertaking these experiments from the fact that, so far as I am informed, no experiments of the kind have been undertaken in this country, which have been accompanied with the necessary analyses. So also, the universal use of the milk of the cow makes it an important subject for investigation: the young of all mamiferous animals are fed upon it, and it contains, in its healthy state, all the elements of nutrition, in the proper proportion to supply the materials of growth: it is the standard from which we may derive important rules for regulating our own diet. We may infer that, as it is the nutriment prepared for the young, it must contain not only the proper elements of support, but also the proportion and combination best adapted to the wants of the living system. It must also be obvious, upon a moment's reflection, that the milk of animals will differ. The flesh feeder will secrete milk whose properties will differ somewhat from the vegetable feeder. Taking the classes of animals by themselves, no one would be surprised to find their milk differing in the proportion of its elements. Let us look at this subject for a moment, taking the analyses of the most distinguished chemists in this department of science. The late FRANK SIMON gives us the following analyses of the milk of animals:

	Cow.	Ass.	Goat.	Ewe.	Bitch.
Water,	857·0	916·3	868·0	856·2	657·4
Solid matter,	143·0	83·5		42·0	342·6
Butter,	40·0	1·1	33·2	42·0	162·0
Casein,	72·0	18·2	40·2	41·0	174·0
Sugar and extractive matter,	28·0	60·8	52·8	42·0	29·0*
Salts,	6·2	3·4	5·8		15·0

* Only a trace of sugar, mostly extractive matter. Taste, saltish and mawkish; odor, unpleasant. SIMON.

It will be observed that milk derived from the sources referred to, is furnished with precisely the same elements, but these elements are combined in different proportion. To these analyses, I may add that of Simon's analysis of the female of our own species. In this instance also the same elements exist, but their combination and relative proportion differ from the others, as will be observed by the following results:

Water,	883·6
Solid matter,	116·4
Butter,	25·3
Casein,	34·3
Sugar and extractive matter,	48·2
Salts,	2·3

Notwitstanding, however, the existence of this fact, the milk of our domesticated animals has been used extensively for the nutriment of our own species, without detriment or hurt.

We have now seen what the milk is composed of, approximately; three important substances, which differ materially from each other, and which, therefore, may be regarded as performing different functions in the animal economy, these are butter, cheese and sugar.

The foregoing will serve to give the reader a general idea of the composition of milk. I considered that it was necessary that this statement should be first given, that the general idea of the milk of the cow might be well understood. We require this for the knowledge of the effects which food has upon the composition of the milk. What the cow eats becomes both flesh, blood and milk; the system appropriates out of it so much as may be necessary for its wants. Now the animal has peculiar functions, and peculiar apparatus to fulfill these functions, each part having its office. The functions of some parts seem to be more chemical than others; some border closely upon physical, as the separation and conveyance out of the body of the excrementitious parts.

The cow which I employed in the experiments is small, and of the variety called the Dutch breed, with short inturned horns; her color is red, with a few white spots along the back; her weight, in November when at grass, was 890 pounds. Her calf, which was then seven months old, weighed 348 pounds. On being confined to the stable she ate from 21 to 27 pounds per day of good hay. The average amount of hay for one week, during the last of November and first of December, was 155 pounds, or about 22 pounds per day. The water drank amounted, during the same week, to 298 pounds and 12 ounces, or a little over 42 pounds per day. The solid excrements amounted to 309 pounds and 8 ounces, or a little over 44 pounds per day. Her calf had given her the same kind of rations, at the same time, and ate of hay 85 pounds and 4 ounces in seven days, or about 12 pounds and 3 ounces per day, and drank during the time 120 pounds and 12 ounces of water, equivalent to 17 pounds per day; and made 144 pounds and 11 ounces of excrement, which is equivalent to 20 pounds per day. A large horse consumes 31 pounds of hay per day, and makes solid excrement to the amount of 82 pounds and 8 ounces for the same period.

It seems to follow, from these facts, that an animal fed upon dry hay requires an amount of water, at least, which will be sufficient to restore the water to the hay which was lost in drying, or in being changed from grass to hay.

To prosecute, successfully, experiments which I am about to detail, requires a subject which is gentle and composed; a cow which is restless, and of a nervous temperament, will, especially under confinement, become impatient and fretful; one too, which is naturally wild, will always be a bad subject, and her milk will vary, probably not only in amount but very probably in quality also, from trivial circumstances, and independent of the quality of her food; analogy points to such a result. It is well known that the milk of the female of our own species is invariably changed by circumstances, and to that degree, in a few recorded cases where the influence was of a moral kind, that death of the infant has followed from its immediate use of the parent's milk, and while under those influences. My cow, I believe, possessed the requisite qualities to fit her for the objects I had in view. She was docile and gentle, and easily milked, and though not at all remarkable for the quantity, she habitually gives, yet the quality has always been remarkably good, especially in the quantity of butter which it has furnished at different times. I think, too, that her system feels at once the effect of the food, and that it is not lost or dissipated in unproductive matters, but supplies it with sustenance which is expended in keeping it warm and supplying wants which have resulted from the ordinary waste of the system, and which is not excessive from extraneous circumstances. The opinions of physiologists have not coincided in respect to the influence of food upon the quantity and quality of milk. Boussingault maintains that it is not essentially affected in quality and quantity, provided each kind of food is administered in equivalent proportions, or which is about the same thing, provided we give the more watery and poorer kinds of food in such quantities that its poorness is made up in quantity. This opinion, however, does not seem to be sustained by Thompson's experiments, made by order of the British government; and my own experiments, so far as they are made in the same line with those of Prof. Thompson, go to sustain his results: beside, it is a natural view to take of the matter. Milk is derived from the food, and it must partake substantially of its properties. It is not a substance, properly speaking, which is created, but compounded of preëxisting elements. If there is a deficiency of one element in the food, we may well suppose that the milk will contain less of it. Some kinds of food must make more cheese than other kinds: some pasture lands of this State make, all things being equal, better butter than others. But there is undoubtedly a limit to the influence of food upon this secretion. There is a capacity of gland or organ which limits its capabilities; it has its capacity determined by its growth; it is an individual organ, and it is, as it were, guaged by the constitutional peculiarity, and any increase of food, beyond a certain amount, of whatever composition it may be, can not affect the secretion beyond a certain limit. Probably the law of her constitution can not be controlled, certainly with safety. The object which the farmer must have before him is to keep his animal up to her full capacity, without carrying his stimulus for milk beyond that point. The secretion is not so much influenced by food as that of the kidney: but disease, in both cases, modifies the products of these glands. In the

southwestern States there is a disease which is endemic and peculiar to certain localities, where the cow becomes affected, and her milk and flesh are both poisonous; and from the fact that the milk has acquired this poisonous property, it is called milk-sickness. The term is however rather applied to cases of sickness in the human species, where it has been induced by its use. Few recover from its effects, and where life is prolonged, the individual lingers out a miserable existence. In this case the milk has acquired new properties, and though they are not detected in its physical or chemical properties, still it has undergone a change: the poison is concentrated in the oily part of the milk. This is only a single instance where the milk is changed by some cause acting upon the blood, from which the milk is formed. It is not, however, important to the end I have in view to consider the individual diseases which act upon this secretion, it is sufficient to advert to it in this connection.

Another fact which I wish to allude to, in passing, is the difference in the proportions of the elements of milk in winter and summer, taking a given weight of each for comparison. Winter's milk is at least richer in butter and casein, or curd, than summer's milk. This position, or view, however, is derived mainly from the composition of winter's milk, as determined by myself, and summer's milk, as determined by THOMPSON and BOUSSINGAULT. In all my analyses of the milk of the cow, which I have relied upon for my results, I have uniformly obtained a much larger amount of butter than is given in the analyses of the chemists I have just referred to, and have reason to believe my results must be correct. The employment of ether for obtaining the butter, or oil, must give a result which can be relied upon for butter, as it neither dissolves the casein, sugar or salts. The amount of casein and sugar which I have obtained I have more doubt about. The mode which I have followed in conducting the analyses of milk is that of HAIDLEN. Four hundred grains of milk are taken; these are mixed with one hundred grains of ground gypsum and boiled. The milk coagulates by boiling, and it is afterwards continued upon a sand bath, in the capsule or evaporating dish, resting upon paper which is not allowed to burn. It is there dried, until it ceases to lose weight: the loss of weight gives the water. The dry pulverized mass is then exhausted of its butter, or oil, by strong and boiling ether: the ether is dissipated by heat, and the capsules and butter obtained are weighed. The solid residue is afterwards acted upon by common alcohol, which dissolves the sugar and extractive matter. The casein, or cheese, is obtained by adding together the sugar and butter, and subtracting this sum from the solid matter of the milk, or that which remains after the water is dissipated by heat. To confirm the result, so far as the casein is concerned, another 400 grains of skimmed milk is used, which is coagulated by a drop of sulphuric acid: the mass is dried as before, the whey turned off or strained off; a small quantity of butter is dissolved out by ether; the residue is casein, in combination with a small quantity of the saline matter of milk. This last, the saline matter, or ash, is obtained by drying down 1000 grains of milk, of the same milking, and then burnt in a capsule to a white ash. This ash is used for the inorganic analysis. Pursuing, in each analysis, the mode detailed above,*

* I should observe that the three first analyses were not conducted in the way I have described. The milk was dried down without the aid of gypsum; in other respects the analyses were alike.

I obtained comparable results, notwithstanding organic matters are not so susceptible of accuracy as inorganic, as a general rule.

I shall now proceed to the details which are intimately connected with the analyses of milk. In the first place, it is necessary to state that the cow was feeding upon the grass of the pasture, which was not very abundant—middle of November; but to make up any deficiency there might be in the feed, pumpkins were given every day, which did not appear to add to the quantity of milk the cow was giving at the time. The milk, as I have already stated, was always of the kind which is called rich. It had the following composition while the animal was feeding upon grass:

Specific gravity, 1032.

Water,	85·80
Solid matter,	15·55
Butter,	5·76
Casein,	5·02
Sugar and extract,	3·83

A quantity of the same milk was churned; it gave per pound of milk 457 grains of butter, which is equivalent to about 5·9 per cent, after deducting the casein.

The composition of grass, cut past the middle of November, is as follows: 500 grains gave, on being well dried in a water bath, 160·4 grains: ash, 11·32. 100 grains of this dried grass gave,

Chlorophyl, or wax,	5·08
Sugar and watery extract,	21·60
Fibre,	73·32

The ash, or inorganic matter, contains,

Silex,	46·12
Earthy phosphates,	16·20
Carbonate of lime,	10·60
Magnesia,	0·86
Potash,	14·63
Soda,	9·40
Sulphuric acid,	0·47
Chlorine,	0·06

The ash of milk gave nearly 50 per cent of earthy and alkaline phosphates, or 1·48 in 3 grains. This analysis of the ash of grass, is not given so much for the light that it throws on the composition of milk, it is given for the purpose of showing the composition of grass at this season of the year. The chlorophyl, which is of the nature of wax, is supposed, by Prof. Thompson, to be used or consumed in respiration, and is not employed in the formation of milk; the excess which remains after this expenditure, is found intermixed with the solid excrements, in an unchanged condition. The sugar and soluble parts in water, as albumen, furnish the materials for the milk.

Having a quantity of turnip tops, intermixed with small turnips, the cow, in the next place, was confined to that diet for five duys. The milk, on being analyzed, gave the following results :

Water,	84·73
Solid matter,	15·26
Butter,	4·76
Casein,	7·55
Sugar and extract,	3·60
Salts,	0·78

A single analysis, if it may be depended upon, shows an increase of casein, or cheese, and a corresponding diminution of butter. The result is one which I believe might be expected, although a single analysis should not be relied upon, when a principle is to be established. The cow was fed upon the tops to her satisfaction, and was apparently fond of the food, but it imparted to the milk a turnip taste. The ash of turnip tops has the following composition :

Silex,	16·60
Earthy phosphates,	13·20
Carbonate of lime,	38·60
Magnesia,	1·51
Potash,	9·13
Soda,	3·94
Sulphuric acid,	5·92
Chlorine,	6·05

Five hundred grains of fresh turnip tops gave 80·1 grains of dry matter ; water, 419·9 ; ash from the same, 14·4, or 2·88 per cent. Turnip tops are rich in lime, and only moderately so in the earthy phosphates and in potash. The silex is liable to some variations in the results, from adherence of dust to the rough leaf ; and therefore probably is in excess, or greater than belongs really to the composition of the leaf.

The value of hay, as a ration for milch cows, has never been fully determined. It is, however, the most important of all kinds of food : it is the main dependance, except in cities, where brewers' grains and distillery slops can not be obtained. It is the natural food, and animals always eat it without beng cloyed. The proximate organic analysis of hay yields the following results :

	Timothy.	Red top.
Fibre,	68·14	65·00
Wax and chlorophyl,	2·80	11·62
Albuminous matters,	4·13	3·29
Dextrine,	2·00	
Sugar and extract,	6·20	9·00
Water,	12·30	10·00
Resin,		2·08

In all kinds of hay, the sugar and albuminous matters, the dextrine and starchy matters, contribute to the formation of milk. The fibre, which is rarely exhausted though not very nutritious, contributes to make bulk, and the wax and resinous bodies, and chlorophyl administer to the respiratory functions, and in consumption are expended in the production of animal heat, or in other words, are burned in the system. The inorganic parts furnish the saline parts to the formation of the earthy phosphates and alkalies. The ash has the following composition :

Silex,	53·95
Earthy and alkaline phosphates,	12·05
Carbonate of lime,	0·25
Magnesia,	0·04
Potash,	13·95
Soda,	5·63
Sulphuric acid,	5·50
Chlorine,	1·31

The hay was mixed with the various kinds of grasses, but timothy and red top predominated. I have already stated the quantity of hay and water consumed per day ; I shall now state the amount of milk which the cow gave while hay constituted her whole nutriment. The whole amount of milk given in seven days, including the last days of November, was 69 pounds, nearly equivalent to 10 pounds per day. About one pound more was given in the morning than evening. The milk of the 12th of December gave the following composition :

Water,	86·19
Dry or solid,	13·81
Casein,	6·17
Butter,	5·64
Sugar,	2·02

The milk produced from hay may therefore be regarded as good. There is a preponderance of casein, less sugar, and the usual amount of butter. The continued influence of hay, however, on the quantity of milk, resulted in its diminution to about 4 pounds in the morning and 3 pounds at evening. If hay could be softened by soaking in water, or if cut and wet or moistened for a few hours previously to being given to the animal, its nutritious matter would be extracted in less time, and with less labor for the digestive organs, and moreover, an increase of nutriment would be obtained.

I made about this time an analysis of morning's and evening's milk, for the purpose of ascertaining the difference in composition, if any. These analyses gave differences, but I have some doubts in regard to the constancy of those differences. I will give them in this place, although I do not know that the inquiry is a matter of much moment.

	Morning. Sp. gr. 1031.	Evening. Sp. gr. 1031.
Water,	84·54	82·40
Dry,	15·46	17·60
Casein,	5·91	7·36
Butter,	6·87	7·40
Sugar,	2·70	2·85

The quantity given in the morning is greater, and the interval which elapsed between the milkings greater. It is possible the first secretion is richer than the last. I am certain only in the results obtained ; the reasons for those results are not well determined. The animal had been fed upon brewers' grains.

One object I had in taking up the investigation, was to determine the effect of brewers' grains on the composition of milk. The common opinion is that this food conduces to the secretion of milk, but that the milk is poor and watery : this was my own opinion. There is an opinion, which is undoubtedly true, that much of the milk which is sold by the milk men of our large cities is inferior to the ordinary milk of the country—observation proves this. But the inferior quality of the milk may be due to two or more causes. The food may be too watery, and in a condition to injure the general health of the animal, or the confinement in stables, together with the food, may conjointly act to bring about an imperfect action of the milk gland, the result of which may be the secretion of milk poor in butter and cheese. Exercise in the open air is as necessary, if not more so, to the cow as to the human family. Slops never injure cows, unless they are confined to them, and also confined to the stable. For their health, too, it is necessary that they should be supplied with food which requires mastication. Strong pressure upon the teeth is necessary to preserve them in a healthy state : their looseness when fed on slops is due, in a great and important degree, to inaction. There is wanting the stimulus of use and exercise to the jaws, as well as the legs of the animal, and this stimulus is necessary to preserve the balance of the system, and maintain a due degree of health. I have said that slops are not injurious, in themselves. This statement is verified by the fact that small families who keep a single cow and feed her upon refuse matters from the kitchen, is always in a good and healthy condition, and gives excellent milk, as well as large quantities of it, for in this case she is allowed to run and roam at large, and enjoys the luxury of air and exercise. But reverse the circumstances, confine the same cow to the close stable, but feed her in the same way, or feed her upon soft food, that which does not require mastication, and she soon loses her health, her teeth will fall out, and she will become diseased in her hoofs.

The effect of feeding a cow on grains for one week may be seen in the following analysis :

Water,	82·40
Dry matter,	17·60
Casein,	7·37
Butter,	7·40
Sugar,	2·85

The cow was fed half a bushel per day, at first, when after three days it was increased to three pecks. A small quantity of hay only was allowed. Hay had been given exclusively for a few days previous to the use of grains, and the cow had fallen off in the quantity of milk: it was reduced to a little more than 3 pounds in the evening and 4 pounds in the morning, or 7 pounds per day, instead of 10. At the close of the week she gave an average of 7 pounds in the morning and 6 in the evening, a gradual but perceptible gain, which could be attributed to no other cause than her food. It is important to observe, therefore, that the quantity and quality was improved by brewers' grains. The question however may very well be put, whether the good effects would be lasting? On this point there may be some doubt; still, if exercise and air, and a sufficiency of hay be added to the ration to employ the jaws and make bulk, I believe that grains will continue their good effects. In the first place, there is nutriment in them of the right kind, and there is nothing which can be injurious. It is, however, important that I should give several other analyses of milk from cows which were fed, in whole or in part, upon grains. I will select, in the first place, the milk of three cows which were fed wholly upon grains, with the exception of a small quantity of ship-stuff. They receive one bushel per day as their ration, and are confined to the stable. The cows of this stable have high feed, and are generally in excellent order, but are kept for milking from six to nine months, and then are turned over to the butcher. It will be observed that the composition of the milk differs from that which I have given in the foregoing sections.

	1.	2.	3.
Water,	89·166	88·050	87·425
Dry,	10·826	11·975	11·575
Casein,	3·505	4·857	4·105
Butter,	2·825	3·617	2·865
Sugar and extract,	3·805	3·477	3·405
Salts,			0·758

Sp. gravity, 1028·75.

Each of these three samples of milk may be regarded as poor in butter, while each cow, I believe, might be slaughtered and pass for good beef. It is poor for winter butter at least, and for cows which have been milked for several months. The casein, however, maintains a respectable quantity.

The next analysis is of mixed milk obtained from numerous cows which were fed upon grains, and screenings which had been buried in the earth for several months, and when given were mixed with buckwheat bran. The cows received half a bushel, with as much hay as they wished. The principal food, however, may be regarded as grains.

Specific gravity, 1028·05. Ash of 1028·75 grains, 6·72.

Water,	88·44
Dry,	11·01
Casein,	4·44
Butter,	3·47
Sugar,	3·55

It yielded butter, by churning, at the rate of 235 grains per pound of milk, or a little over three per cent. The four samples of milk reach a middling grade in casein, but below the standard in butter, for winter milk: the first and third are considerably below the standard. The preceding varieties of milk, however, would be regarded as tolerably good milk, and if set for cream, the appearance would not differ materially from the milk of summer and autumn.

From the results of the foregoing analyses I am led to entertain the opinion that grains, if used aright, and the cow has sufficient hay and exercise, are excellent food for cows. Exercise, I may remark farther, is necessary to effect a certain amount of waste of the tissues, in order to secure health and material for butter and cheese.

I may add another analysis of milk obtained from the mixed milk of several cows, the same as those which I have enumerated as 1, 2, 3, excepting that it was taken from the cans, and was made up of milk from seven or eight cows. It gives a better result than that which I obtained from the three individual cows. The analysis stands as follows:

Water,	89·35
Dry,	10·95
Casein,	4·30
Butter,	3·65
Sugar,	3·00

I obtained more butter from the whole milk than from the last of the three previously examined. These cows are fully fed upon grains, with a little ship stuff added to prevent the grains from cloying them, as it is apt to do when it is fed alone without addition.

The composition of the ash of milk deserves attention. I subjoin the four following analyses: the two first were the ash of the morning and evening milk of my own cow, while feeding on grains; the fourth of the ash of the milk of a cow also fed entirely on grains, and is No. two already referred to; and another of milk made from hay:

	Morning. Grains.	Evening. Grains.	Hay.	No. 2.
Potash,	23·86	19·67	28·28	28·85
Soda,	3·39	5·24	3·61	5·89
Earthy and alkaline phosphates,	59·48	59·05	55·40	49·61
Chlorine,	10·24	13·94	12·81	13·55

The deficiency of chlorine I am unable to account for in the morning's milk—I give the results as obtained.

If brewer's grains are so nutritious, where and in what does the nutriment consist? Before answering this question I may, or should state that the dose of grains varies from one half to one bushel per day. Quantity is here made to supply the loss which the barley has sustained in the processes to which it has been subjected. Besides it is thoroughly soaked and softened, and brought to that state and condition that the organs of digestion can fully master it, and imbibe from it all that the brewer has left. The material of which it is mainly deprived

in the brewery, is starch. Its albuminous matters, its oil, and some dextrine and extract, still remain, and although a single grain seems to be completely eviscerated by the brewer, yet it has held on to something, and when, as I have remarked, a large quantity is given, a considerable amount of aliment is received. The following result relates immedately to what the brewer leaves. A bushel of grains, after draining, will weigh about 28 pounds. One hundred grains dried in a water bath, at 212° Fah., loses 67 per cent, which is water, consequently the dry grains amount to 33 per cent, yielding 82 grains of ash.

One hundred grains of dry grains yield,

Oil,	1·05
Albuminous matter and some starch and fine fibre,	14·66
Gluten,	1·77
Dextrine,	8·60
Sugar and extract,	11·00
Fibre,	62·92

In washing the dry grains in fine linen, for obtaining the albuminous matter, remaining starch, &c., I found that a small quantity of fine granular particles passed through. The starch is often visible to the eye in the broken grains. Ether dissolves more than 1 per cent of oil, and alcohol dissolved from the remaining fibre 1·77 per cent of gluten or hordien. The dextrine precipitated by alcohol from the solution was much greater than I expected to obtain.

It appears, therefore, that grains contain largely the elements of blood and muscle, in its albumen and gluten; respiratory matter in its oil, dextrine and starch, as well as material for fat in both classes of these elements. One pound of dry grains will contain 76 grains of oil; in 9 pounds of dry grains there is nearly an ounce and a half of oil. In the same quantity of grains there is about 1197 grains of gluten, which is contained in the fibre after the extraction of the albumen, starch and dextrine by water. The 9 pounds of dry grains contain 6372 grains of pure dextrine. The use of about 216 pounds of grains produced in eight days 7·62 pounds of butter, and 8·74 pounds of casein or cheese. The amount of milk was 103 pounds and 2 ounces during the eight days the cow was fed upon grains. In Prof. Thompson's experiments the cow ate in ten days 80 pounds of whole barley, 40 pounds of linseed meal, and 267 pounds of hay, which yielded 7 pounds 2 ounces and 8 drs. of butter, requiring 205 pounds, 10 ounces and 4 drs. of milk. I am however disposed to account, in part, for these results to the character of the individual cows. The composition of milk may appear favorable from other causes, independent of food or season of the year. Thus if the first milk drawn is compared with the last drawn, a striking difference in its composition may be shown. It is a view which has been very generally adopted from casual observation. I wished, however, to ascertain, by direct analysis, the difference of milk obtained in these two stages of milking. Accordingly I obtained milk for this purpose, and obtained the following results:

	First milk.	Last milk.
Water,	89·09	83·37
Dry,	10·90	16·62
Casein,	5·23	5·34
Butter,	2·50	8·60
Sugar,	3·17	2·37

The difference. according to these analyses lies in the diminution of butter, for the sugar remains about the same.

Composition of the milk of the cow when fed upon screenings.

In malting, the sprout which grows from the kernel is detached and dried, and then sifted out from the malt. The dried sprouts are called the screenings, and they form a kind of food of which cows are extremely fond, and farmers regard them as well adapted to cows in the spring. They can not differ much from young grass: they cost fifteen cents per bushel, and four quarts is a safe allowance. Previous to placing them before the cow they are soaked in water; this is required, inasmuch as they are quite dry, even crisped. The cow was fed seven days on this food—ate very little hay: the milk had a specific gravity of 1032·57, and contained,

Water,	86·77
Dry,	13·22
Casein,	5·05
Butter,	5·02
Sugar,	3·15

It is evident the milk did not gain in butter or cheese, but the sugar appears to have increased. The quantity also increased during the time about one pound per day. It is undoubtedly a food suited to the system of the cow which has just come in. This is agreeable to the views of farmers who have been in the habit of using them. It is also recommended for its cheapness, and as it is soaked and swelled, it resembles the best of grass in its texture and composition.

I changed, February 1, the ration of screenings, for oil-cake, upon which I had fed my cow seven days, and then made an analysis of the milk. The weather during this time was cold, generally below zero. The cow improved in appearance, though she was not fond of the meal; she ate it, however, by mixing it with rye middlings; four quarts per day was her allowance with a limited amount of hay. The milk appeared very fine, and did not acquire the least taint of the oil meal, although it might have been expected. The milk, on being subjected to analysis, gave the following result:

Water,	86·92
Dry,	13·27
Casein,	4·56
Butter,	6·63
Sugar,	2·13

The casein was obtained directly by employing skimmed milk of the same milking, coagulating it by a drop of sulphuric acid, straining off the whey, and lightly washing the casein with cold water. As I obtained by this method it agreed with that obtained by the method I had usually employed.

I infer from this analysis that oil-cake increases the amount of butter; or at least, the inference that it is not diminished, is safe. It must however be recollected that it followed immediately the brewers' grains, which had a fine effect, and that when the oil-meal was commenced the cow was giving nearly if not quite her full amount of milk; or in other words, she had reached her full capacity for secreting butter and cheese: the casein had rather diminished. Oil-cake is fed only sparingly to cows in Albany; brewers' grains are so cheap, and being regarded too as favorable to the production of milk, they have become almost exclusively the food of the cow. The value of oil-meal is established as a fattening substance, and one that is adapted to all the wants of the animal economy. It is rich in albumen or nitrogen, and is, therefore, fitted to supply the waste which is going on in the muscular tissues: it is, by far, richer in oil than Indian corn, and is, therefore, fitted to sustain the temperature fully up to the normal standard. Its effects may have been modified by the extreme cold which prevailed during the whole time the experiment lasted. It should have produced more casein, inasmuch as it is rich in albumen. The ash is rich in phosphates, and is hence adapted to supply bone and other solids which require phosphates, as most of the albuminous bodies do. The ash is never pure but intermixed with sand, which adheres to the cake.

The composition is as follows:

Sand and silex,	48·50
Earthy phosphates,	36·60
Carbonate of lime,	0·50
Magnesia,	0·40
Potash,	10·96
Soda,	2·12
Chlorine,	trace.
	99·08

I made at this time an organic analysis of oil-cake, for the purpose of obtaining the quantity or percentage of albumen and oil: it is known to be rich in both; thus I found 100 grains to contain,

Water,	9·00
Mucilage,	30·92
Albumen,	19·70
Oil,	12·25
Fibre,	18·25
Sand and ash,	10·10

Its composition shows that it should form a nutritious and fattening food, and one also well adapted to produce milk of a rich quality. Horses are more fond of oil-cake than cows, and it probably constitutes a kind of food upon which they can perform more work, and with less fatigue than any other.

Prof. JOHNSTON of Durham, England, has placed the value of oil-cake in its true light. He remarks that the percentage of the protein compounds, albumen and gluten, is nearly equal to what is contained in pease and beans; and that therefore, for the production of milk for the cheese dairy, and for laying on of muscle, oil-cakes are as valuable as beans, pease and clover. He goes on to remark, that this result is somewhat unexpected, inasmuch as their value, in the feeding of stock, has hitherto been supposed to depend upon their power of laying on fat, in other words, upon their percentage of oil. I subjoin his analysis of the English oil-cake:

Water,	10·05
Mucilage,	39·10
Albumen and gluten,	22·14
Oil,	11·93
Husk,	9·53
Sand, ash, &c.	7·25

The analysis which I made I had some doubt of the freedom of the fibre or husk from mucilage. The proprietor of the establishment remarked, that occasionally there were portions of the cake which contained impurities, sand, &c., and that tons of these foreign matters were sifted out to his loss. Whatever may be the fact, as to impurities in particular samples of the substance, there can be no doubt of its great value in feeding stock; it is borne out both by analysis and by experience. I may remark, in confirmation of this view, that the cake I employed for analysis was uncommonly impure and filled with sand, by the uncommon quantity of sand which appeared in the ash. Prof. JOHNSTON estimates the amount of ash as at least equal to 6 per cent. One-third of this ash is phosphoric acid; 100 pounds of oil-cake, therefore, contains 2 pounds of phosphoric acid. On the other hand, wheat leaves only 2 per cent of ash, of which one half only is phosphoric acid, or 100 pounds of wheat contain 1 pound of phosphoric acid: therefore, for laying on bone, or supplying the materials of bone to growing stock, oil-cake is twice as valuable as wheat, weight for weight, and more than twice as valuable as oats or barley, which are covered with husk. But this goes to sustain the view which I have stated elsewhere, that flax must be an exhausting crop, inasmuch as the phosphates are derived from the soil; it follows that it is twice as exhausting as wheat.

THE INFLUENCE OF CARROTS ON THE MILK OF THE COW.

I fed my cow with half a bushel of carrots per day, after having finished, for the time, my experiments with oil-cake. The temperature had very materially increased, and the weather was comparatively warm, being a large proportion of the time above 40° of Fah. The carrots were crushed and fed without cooking: hay was allowed, and this feeding continued three

days only. At the expiration of the time the milk was examined, and found to have the following composition :

Water,	86·57
Dry,	13·25
Casein,	3·10
Butter,	5·55
Sugar,	4·60

I had, I confess, formed the opinion that the sugar would be increased, at the expense of the other elements. It seems that the casein is diminished, but the butter, though also less, is not so much affected as the casein. The quantity of milk if any thing increased, but it is rather more watery. The carrots would have been continued longer but for the return of cold weather, which on the morning of the 19th of January was 10° below zero, a temperature entirely unsuited to food which is as watery as carrots and potatoes. The brief period during which the cow was fed in this way renders it necessary to repeat the experiment: I have however become satisfied that the influence of the food on the milk may be seen in forty-eight hours after a change of diet; still a repetition will be required, in order to confirm or disprove the special influence of the food in this case.

About this time I observed that the slops or distillers' swill was used for food, both for cows and hogs. It is a thin, gray, watery looking compound, and is distributed hot to the customers, at about six pence per barrel. It is used to wet the hay, when hay enters into the rations of the cow, or drank if hay is not allowed; the cow is said to be fond of it I procured some milk from a neighbor, who fed his cow in part upon this matter. I expected to find the milk watery, and so I was not disappointed, though it was better than I expected.

Specific gravity, 1025·56. Ash, ·77 per cent.

Water,	88·19
Dry,	11·81
Casein,	3·03
Butter,	5·03
Sugar,	3·75

I have a favorable opinion of a cow which gives milk made from slops of the distillery: the cow however received her allowance of slops in the most unexceptionable way; hay moistened or wet with nutritious matter is improved, becoming more digestable and more easily masticated, and of course better prepared for digestion. I have no doubt it is important in the economy of the cow, and of all animals furnished with teeth, that they should be used. All slops, under any circumstances, would ruin a chewing animal, and much of the evil experienced by cows kept in stables in cities is the soft nature of the food with which they are furnished. The disuse of the organs of mastication, and those of locomotion, are undoubtedly the cause of the diseases under which they so speedily suffer. There is another fact which proves the good

quality, in the main, of this milk, it is the amount of inorganic matter it contains, being quite as large as that from milk less watery.

I made an analysis of the ash, and give below the result.

Potash,	23·896
Soda,	3·833
Alkaline and earthy phosphates,	57·662
Chlorine,	13·760
Insoluble matter,	0·260

In this milk the specific gravity was low, the water was comparatively large, the casein, for winter milk, small, and yet the percentage of ash large.

I wished to ascertain the quantity of grains which may be fed profitably to cows. Before making my experiments directly, I analyzed the milk, in order to determine its condition at the commencement of the experiment. I found it as follows, on the 1st of February: temperature, 12°, 10°, 8° below zero of Fah. for three successive mornings.

Water,	86·92
Dry,	13·07
Casein,	4·56
Butter,	6·63
Sugar,	1·87

I employed, in the first instance, half a bushel of grains, mixed with cut hay, for three or four days: the temperature was 8° below zero. I analyzed the milk of two successive mornings, and find it as below.

Water,	84·85	86·05
Dry,	15·15	13·95
Casein,	5·75	5·52
Butter,	5·27	5·54
Sugar,	*4·15	3·29

The grains were increased to a bushel per day, and fed with the same quantity of hay which I had been giving. The weather became much milder, and the temperature was about 32° during the whole time: the cow was receiving one bushel of grains per day. The 11th of February I found the milk consisted of the following elements:

Water,	86·70
Dry,	13·30
Casein,	5·42
Butter,	5·07
Sugar,	3·00

* The sugar was lost—the numbers supplied by adding the butter and casein obtained, and subtracting from the dry milk.

From this result, as it stands by itself, I can see no gain or profit from feeding over half a bushel of grains per day, especially when the animal receives a suitable amount of hay. Food, in order to influence the secretions, must be assimilated, and it may be that a bushel is more than the digestive organs can assimilate. The milk was neither improved in quality nor increased in quantity.

Milk as influenced by temperature.

The quality of the milk has proved better during the coldest weather than when it has been mild or warm: the quantity, however, has been less. This is agreeable to all former observations. The waste of the tissues is greater—more matter is consumed in preserving the normal temperature. This waste must diminish the quantity of material which would otherwise be directed to the mammary gland; but the waste is less diluted with liquids, and hence the milk contains more albuminous or cheesy matter. It appears that oleaginous matters are not employed exclusively in making the butter; at least the butter is not necessarily increased by those substances which contain oil in abundance, as we have seen in the use of oil cake. The best food for milk is that which is capable of being converted into muscle and bone. Food containing oil or fat is however necessary: most of the secretions require, for this purpose, fat or oil, or at least the secretions themselves contain it: the brain itself is rich in those bodies. Fat, therefore, is used in the animal economy for various purposes. It keeps the animal warm, forms a part of the essential organs, enters into the secretions, and gives that roundness of form which is usually regarded as essential to beauty.

The season of the year may, therefore, be regarded as a cause capable of altering the quantity and quality of the milk. The butter amounts to only four per cent, in the summer, in some of the breeds, when they feed upon grass. The same result is also obtained in winter, according to Boussingault, when cattle feed upon roots. The butter and cheese being increased considerably in winter, by the food, it is highly probable that butter and cheese might be made in winter with as much profit as in summer, provided the farmer supplied himself with suitable accommodations.

Quality and quantity of milk furnished by the different varieties or breeds of cows.

It is a well established fact that there is a constitutional susceptibility, by which, not only certain cows yield a larger quantity of milk, but also that of a quality superior to other cows. This constitutional power to produce more and better milk is transmissible to offspring, and hence, it follows that certain breeds or varieties possess an excellence and value which is not common to the species. Those breeds or varieties possessing those important peculiarities are the more valuable in consequence of the expense required to keep them: the value of the products is not dependant upon the cost of their keeping, hence the greater profit arising from the raising of the better varieties of stock; indeed it not unfrequently happens that an inferior variety will consume a greater amount of food than those which produce the best and greatest amount of milk.

For comparison, I will state the composition of the milk of the common variety of cows, or of the native breed :

Water,	88·19
Solid,	11·10
Butter,	4·06
Casein,	4·00
Sugar,	2·75
	99·90

To the foregoing I may add the analysis of the milk obtained of Mr. Kirtland, of Greenbush. It was taken from the common tub, containing a mixture from all the cows.

The following is the composition :

Water,	88·49
Dry matter,	11·45
Casein,	5·43
Butter,	3·47
Sugar,	2·55

One thousand grains of milk gave 6·729 ash. By churning, one pound of milk gave 375 grains of butter.

These cows were fed upon brewers' grains, wheat bran and screenings. The grains were old having been of the previous autumn.

Another analysis of the milk of my cow, of the Dutch breed, and which was made the first of February, 1851, gave the following proportions :

Water,	86·92
Dry,	13·07
Casein,	4·56
Butter,	6·63
Sugar,	1·87

It would seem, from many analyses, that certain animals give a milk rich in butter, while another gives milk rich in cheese or casein. This difference does not seem to have been attended to. Those cows, for example, which give a milk poor in butter are generally regarded as furnishing poor milk, though for cheese they may be very superior animals.

I am now prepared to give an analysis of the milk of the Durham cow. To obtain this milk I applied to Mr. Vail, of Troy, who has for many years, as is well known in this vicinity, bred this variety. The animal was five years old, and gave fourteen quarts per day, and was fed on cut hay, stalks and grains, and was, moreover, thin in flesh.

The milk had a specific gravity of 1030·4. I obtained the milk the 26th of February, and it gave the following results :

Note. It is proper to state that it is winter milk which will probably be found richer in cheese and butter, and dry matter, than summer milk.

Water,	89·37
Dry,	10·72
Casein,	4·40
Butter,	4·70
Sugar,	4·72

The casein obtained by acid 4·08. The butter by churning, 304·55 grains to one pound of milk. What is worthy of remark is the uniform composition of the milk, in butter, sugar and cheese. The Durham, it is evident, is a good dairy cow; though less rich in butter and cheese, yet the value is made up in the quantity of milk per day which this breed usually furnishes.

The next variety which I shall notice is the Ayrshire. The milk was furnished by Mr. Prentice, from an excellent animal, which may be regarded as a perfect representative of this breed. The milk was furnished the first of February: its specfic gravity was 1032·90.

The composition was as follows:

Water,	85·94
Dry,	14·06
Casein,	4·65
Butter,	5·42
Sugar,	3·98

One thousand grains gave 7·24 of ash. The cream was thick and yellow, and the butter amounted, by churning, to 516 grains to the pound of milk. At the temperature of 56° Fah. the butter came in eight minutes. The cream required diluting with the skimmed, in order to agitate it properly. The time occupied in churning the milk of the Kirtland cows was thirty minutes, and the butter was white and granular. It seems to follow, from all the analyses of the milk which I have made, that where the milk contains a large quantity of butter, that it is of an excellent quality. It would be rather an anomaly for a cow to give milk rich in butter, and that butter white, granular, and intermixed with casein, which are the characteristics of poor butter. I have not heard remarks to this effect, and may labor under an error, but the numerous opportunities which I have had for observation bear out the justness of the foregoing remark. In cheese making, the great object will be to secure cows which give the largest quantity of milk, for we may expect to obtain thereby the most casein, with sufficient butter to impart richness to the cheese. A cow of the Ayrshire breed would be less profitable for cheese making than the Durham, though her milk is richer.

While engaged with these analyses I failed in obtaining the milk of the Devonshire and some other varieties, and hence I have been unable to institute comparisons as to the qualities of the milk. I subjoin only one more, the milk of the Alderney or Jersey cow, which was furnished me by Mr. J. A. Taintor, of Hartford, Connecticut. To set forth the value of the milk of this breed, I propose first to give the analysis of the Ayrshire's milk, from Prof. Thompson's work on the relative value of food for the production of butter, and published by order of the British government. These analyses were made however in warm weather, or

during the summer, and hence they do not compare so well as if made in the winter. The specific gravity of the milk of the Ayrshire cow was 1029. It contained,

Water,	87·19
Dry matter,	12·81
Butter,	3·70
Casein,	4·16
Sugar,	4·35
Ash,	0·59

The milk, as I have already remarked, was furnished me by Mr. Taintor, who also gave a brief account of the state and condition of his animal, in the subjoined letter. The milk was sent by express, in a bottle, filled nearly to the cork, and was received in good condition. It was agitated slightly, its specific gravity taken, and sixteen ounces weighed out for butter, which was allowed to stand thirty-six hours, when the cream was removed. Its specific gravity I found to be 1031·1. It was composed as follows:

Water,	84·73
Dry matter,	16·27
Butter,	8·07
Casein,	5·02
Sugar,	3·05
Ash,	0·79

The result is worthy of notice, in each particular, viz: the specific gravity is high; there is less water, and the proportion of dry matter is large and the quantity of butter remarkably great, while the casein is also above the standard of other cows.

The butter was obtained by ether, in the first instance, and afterwards by churning. The cream was thick, yellow and rich. It was churned at the temperature of 68° Fah. In the process it thickened so much that I diluted it with skimmed milk, to give it movement. The butter, by my mode of proceeding, came in eight minutes from the time I commenced; but I was obliged to lose about three minutes in the operation, and hence it may be set down at five minutes. The butter, on its first appearance, was in hard lumps, and free from grains, and of a rich yellow, and comparatively dry and free from casein and butter-milk. One pound of milk gave 706·79 grains of butter, equivalent to 9·33 per cent. This result appears greater than that obtained by ether: there should, however, be deducted a small quantity of water and casein; but its condition was that of the best of table butter—it can not be exceeded in fineness.

Mr. Taintor's Letter, giving some account of his importation of the Alderney or Jersey Cows.

Dear Sir:

On my return home, I found your favor of the 4th instant: I cheerfully comply with your request, and send you by express a bottle of Alderney milk. My Alderney cows had a very

Note. My process for churning was, in each instance given, to shake it in a wide-mouthed, vial or bottle, closely corked.

long passage, and the hay having fallen short, they arrived in a most pitiable condition, and have not yet fully recovered. The cow from which I shall send the milk is five years old next June, has recently calved, and is in poor condition, has only been fed all winter upon hay, with four quarts of grain daily. She gives now eleven to twelve quarts of milk in 24 hours, and the butter is far superior to any I have ever seen in this country. These animals I selected, myself, as the very best; paying from £18 to £25 sterling, for extra cows.

Very respectfully, yours.

JOHN A. TAINTOR.

Hartford, Feb. 13, 1851.

It is, perhaps, impossible to determine the cause which operates in cows, in a manner which changes the proportion of elements in milk, while they are fed upon the same food. It may be due to the powers of assimilation and nutrition, at least in part. The power of assimilation varies in individuals, and hence individual peculiarities, as to the quality and quantity of milk, are met with in the same breed, while the general characteristics have arisen from constitutional perfection, which is more or less transmissible to their offspring.

Ordinary butter contains almost twelve per cent of water, and one per cent of curd. If a deduction is therefore made of water and curd, the two results, that by ether and churning, will correspond very closely. Both results indicate a remarkable richness in butter, and the mode by churning is direct, and can not have led to error: the one by ether is, however, very reliable, and hence we have no occasion to distrust the results obtained. What I now say applies to all the foregoing analyses—they are perfectly trustworthy. According to the foregoing results, then, the milk obtained from the Jersey cow would give 12·32 pounds of butter weekly, as she yielded 154 pounds of milk; while the Ayrshire, from Prof. Thompson's experiment, would yield only 11 lbs. 11 oz. and 11 dr. in sixteen days, from 309 lbs. 14 oz. and 6 dr. of milk. During an equal period Mr. Taintor's cow would yield 352 lbs. of milk, and 28·16 lbs. of butter, which shows a balance of 18 lbs. in her favor. The Ayrshire of Mr. Prentice gave 516 grains of butter for 16 ounces of milk. Milk taken from the cans of the milkmen of the city yield scarcely 375 grains, with its curd and water, and the more common run of milk, as sold to families in the city of Albany, will only yield,

Water,	90·48
Casein,	3·88
Butter,	2·88
Sugar,	2·78

And this is regarded as very good milk.

The Jersey cow is constitutionally quiet and docile; the male, however, is more fierce, when he has attained two or three years. The breed is capable of being acclimated to the colder sections of our country, inasmuch as it is said to stand the Scotch winters without injury. This power indicates a soundness in the vital powers, or of a vigor in the functions of animal and vegetable life equal to the Devon, or either of the breeds now reared in the pastures of New-

England and New-York. So it is said that the Jersey cow fattens rapidly while in the stall, and that she produces excellent beef, though, to the eye of some, it may be too yellow. There will arise an advantage to the butter maker in possessing one or more of the Jersey cows, as their cream will impart to the butter of several cows the rich color of their own, and to some extent the flavor also. It is observed by Col. Le Couteur, that in Jersey the calf is taken immediately from the cow, and brought up by hand. This plan is objectionable in all cases, and the practice of killing the calf at two or three days old is reprehensible. It is, perhaps, followed with apparent gain for the time, but still the milk of the cow is not fully established in that time, and no milkers can effectually develope the secretion of milk so well as the offspring. In the long run it has an injurious tendency, and the mammary gland will never attain to that perfection that it will when the calf is allowed to suck three or four weeks.

It may be interesting to state the composition of the milk of the female of our own species. The following result was obtained by an analysis of the milk of a person who had been nursing some two or three months. Four hundred grains gave,

		Per cent.
Sugar,	19·35	4·83
Butter,	5·39	1·34
Casein,	12·17	3·04
Water,	363·11	90·77

Human milk, therefore, contains more water than that of the cow, and more sugar. The casein, or cheese, is about the same, while the butter is considerably less again. In preparing milk for the infant which is to be fed, the cow's milk requires dilution with water, and an addition of white sugar; or the milk may be skimmed, after standing six or eight hours, and the sugar added. The respiratory movements of the infant do not require that amount of oil or carbon to sustain them as the adult. The large proportional amount of casein furnishes abundant material for the infant's growth and development. The absolute quietude of most infants for the first month, does not enable it to consume a large amount of carbon in its respirations. When however it begins to exercise, the carbon may be increased by giving it milk richer in butter. The error which nurses often commit, by giving infants the top of the milk as it is called, is quite obvious when the composition of its natural food is consulted.

Conclusions and summary respecting the relations of food to the quantity and quality of milk.

1. The casein and butter may be changed relatively as to quantity and quality.
2. The butter is increased at first by brewers' grains, and in some instances the butter may be raised to the maximum quality.
3. Barley screenings scarcely maintained the amount of butter up to its standard, yet the quantity of milk increased.

4. The addition of oil cake does not increase the quantity of butter, although it contained 12·25 per cent of oil. This fact goes to show that oil is not employed in the animal economy in the manufacture of butter; neither will the milk become oily and taste of oil, as has been supposed.
5. There is a capacity for milk belonging to each cow, which, although the winter's milk may be increased by diet, yet the limits will be determined by the animal economy, and not wholly by the quantity and quality of food.
6. In feeding, the quantity of nutriment required being given, an increase of quantity beyond that amount is lost, or it is not assimilated, or will not be employed in making milk.
7. The milk first obtained is poor in butter, the last rich: see analysis, p. 324.
8. The *casein* increases by nitrogenous compounds, as oil cake, grains, &c., but there is no increase of butter by the use of oily compounds.

The first milk is poor, both in butter and casein, and comparatively rich in sugar, but is more watery by over 6 per cent. The common opinion here is, therefore, correct, and is well understood, as I am informed, by some of our milkmen, who, to make their butter, save the last of the milking, and supply the first to their customers for their coffee.

The effect of food upon the value of the solid excrements.

When an animal is fed upon hay, whether it is a cow or a horse, more than half of the solid excrement will consist of silica, and being a substance which is not taken into the system, or if it is, only more sparingly than any of the elements which enter into the composition of food.

Manure of the horse and cow fed exclusively upon hay, has the following composition:

	Horse.	Cow.
Silex,	67·00	63·00
Phosphate,	8·50	21·40
Lime,	3·50	1·20
Magnesia,	0·35	
Potash,	6·30	3·65
Soda,	5·25	3·28
Sulphuric acid,	4·40	6·26
Chlorine,	0·40	0·08

The value of manures depends on the food: though the silica for the cereals and grasses I deem important, yet for turnips—the esculents, their silica is almost useless.

Feeding with screenings increased the amount of solid matter in the excrements: from hay it was 19; screenings, 23; oil cake, 25; and so there is an increase in the phosphates thus,

Analysis of the ash of cow manure, from brewers' screenings and oil cake.

	Screenings.	Oil cake.
Potash,	4·44	8·62
Soda,	7·20	1·80
Earthy phosphates,	22·63	27·10
Carbonate of lime,	2·01	2·20
Magnesia,	1·07	1·41
Silica,	56·90	58·10
Sulphuric acid,	8·62	2·00
Chlorine,	0·21	0·20

The oil cake upon which the animal fed contained a very large percentage of silica, or sand, and hence gave quite a large product in the excrement. The excrement of the horse contains of dry matter 21, and of water 79 per cent; matter soluble in alcohol, ·35; wax, or resin, ·67: ash of the 21 per cent 1·8, loss ·03. The excrement of the cow, when fed upon oil cake, contained water 73·80; of dry matter when dried at 212°, 26·20.

I made the following analysis of provender, made of Indian corn one part and oats two parts, and rye middlings; both are used largely for feeding horses:

	Provender.	Rye middlings.
Starch,	36·90	35·48
Oil and gluten,	1·40	1·70
Albumen,	2·90	7·12
Dextrine,	1·80	7·15
Sugar,	8·90	14·80
Fibre,	33·50	17·40
Water,	13·30	0·00

In the analysis of the rye middlings the water was not determined, but in the cereals it does not vary much from fourteen per cent. From these analyses, rye middlings contains more nutriment than provender composed of one bushel of corn and two bushels of oats: the amount of fibre is large in the provender, being about twice as large as in the rye middlings: the albumen and dextrine is much greater in the rye than in the provender. Those who have used rye middlings for horses, speak favorably of it as a kind of food for them. For myself, I have never seen better results from the food for a horse than twelve quarts of oats per day, especially if given regularly, and at stated hours. The latter condition is indispensable in the feeding of all kinds of animals. Nature has her periods: periodicity is one of her laws. A farmer who is precise in his observance of this law, in dispensing his food to his cattle, will possess fine flocks and herds; while he who disregards this law will be unable to exhibit fine stock, no matter how much and what he feeds them.

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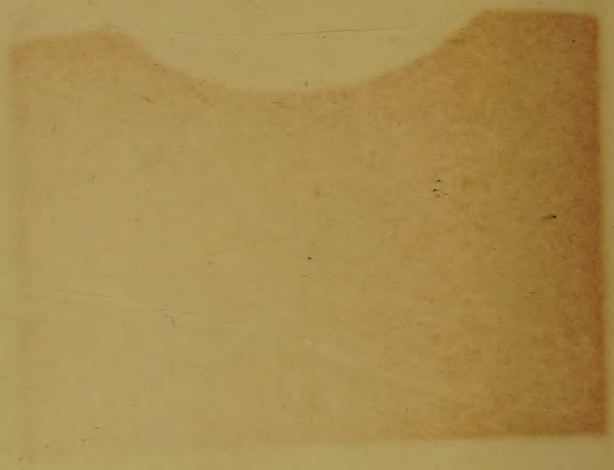

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